THE COAST ARTILLERY JOURNAL

Published as the Journal of U. S. Artillery from 1892 to 1922

MAJOR ROBERT ARTHUR, C. A. C. . . . . *Editor and Manager*

Volume 70 | March, 1929 | Number 3

CONTENTS

Authors alone are responsible for contributed articles.

The COAST ARTILLERY JOURNAL pays for original articles upon publication.

Published monthly under the supervision of the Commandant, Coast Artillery School, by direction of the Chief of Coast Artillery, for the information of the Coast Artillery personnel of the Regular Army, National Guard, and Organized Reserves.

Terms: United States, $3.00 a year; single copies, 50 cents. Canada, $3.25 a year; single copies, 55 cents. Foreign, $3.50 a year; single copies, 60 cents.

Entered as second class matter at the Post Office at Fortress Monroe, Va. Acceptance for mailing at special rate of postage provided for in Section 1103, Act of October 3, 1917, authorized May 8, 1920.

Address: The COAST ARTILLERY JOURNAL, Fort Monroe, Va.

Printed by HOUSTON PRINTING AND PUBLISHING HOUSE, *Hampton, Va.*

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE **MAR 1929**	2. REPORT TYPE	3. DATES COVERED **00-00-1929 to 00-00-1929**

4. TITLE AND SUBTITLE **The Coast Artillery Journal. Volume 70, Number 3, March 1929**	5a. CONTRACT NUMBER 5b. GRANT NUMBER 5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER 5e. TASK NUMBER 5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Coast Artillery Training Center,Coast Artillery Journal,Fort Monroe,VA,23651**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR’S ACRONYM(S) 11. SPONSOR/MONITOR’S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

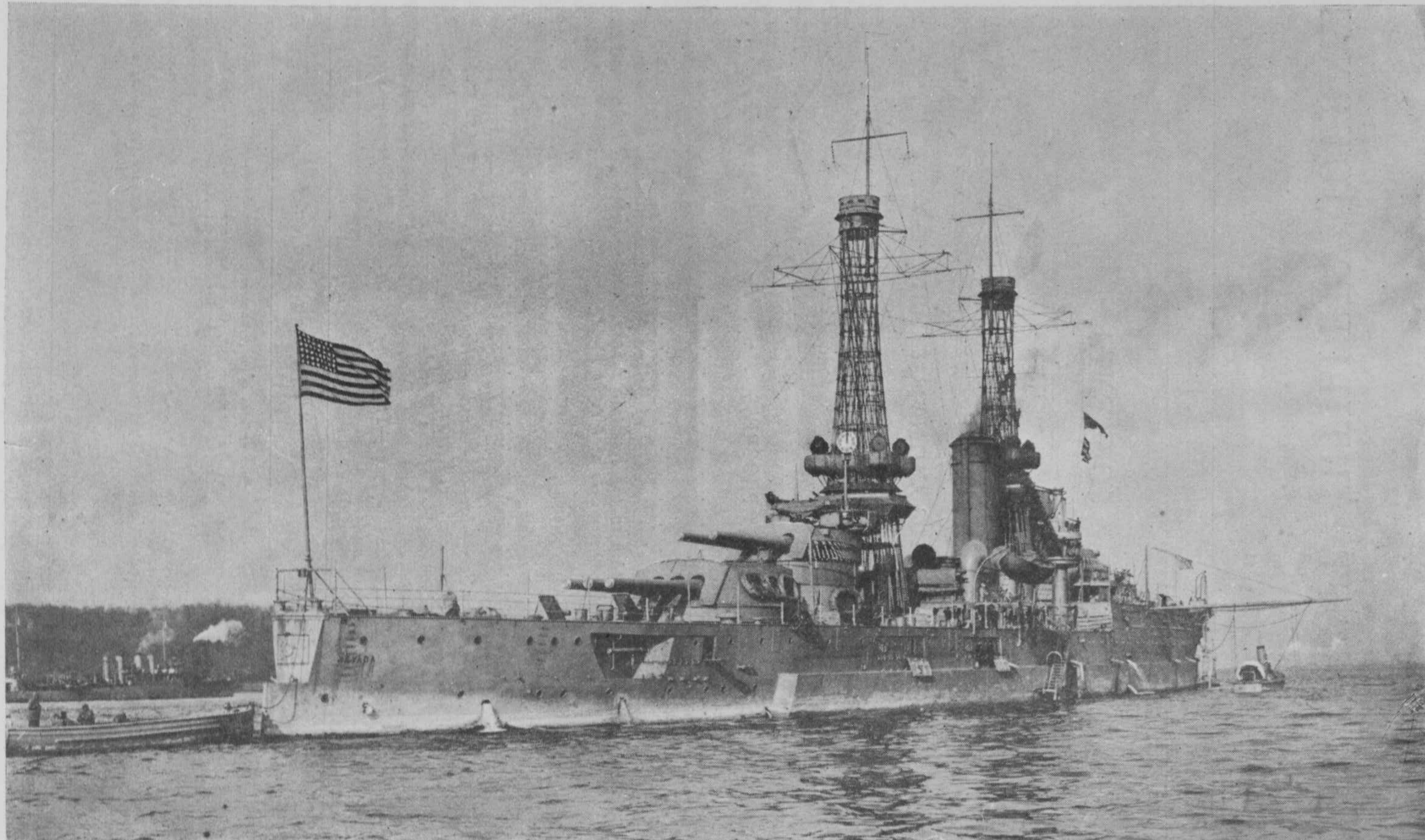
13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT **unclassified**	b. ABSTRACT **unclassified**	c. THIS PAGE **unclassified**	**Same as Report (SAR)**	**96**	

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std Z39-18



U. S. S. Nevada

The Coast Artillery Journal

Volume 70 March, 1929 Number 3

Attributes of Efficiency

A Treatise On the Mobile Antiaircraft Gun Battery

By Captain Benjamin F. Harmon, C. A. C.

First Prize, Annual Essay Contest

IT has been stated, in definition, that "a good gun is a gun that is where you want it, at the time you want it, with sufficient ammunition, and ready to fire." Let us augment this definition somewhat, modify it a trifle, and say of the mobile antiaircraft gun battery:

> *An efficient battery is a battery that can be moved in time to the proper firing position, with sufficient ammunition, and can remain there and be prepared to deliver accurate fire on the proper targets.*

This maxim gives the thought underlying the discussion herein presented.

At the outset, let us select the word *accurate* from the latter part of the maxim, discuss the various ramifications into which it leads and then proceed to dissect and analyze the remainder.

The accuracy of fire of an antiaircraft battery is, paradoxically speaking, incapable of accurate definition, since the use of the word *accurate* implies a standard of comparison. Who shall prescribe the standard and who shall say to what limits of refinement our accuracy should proceed? The accuracy of fire is the result of innumerable small cogs running together to operate the entire machine, which is the battery. We may group them, broadly, under the divisions of (1) materiel, (2) gunnery, (3) training, and (4) opposition.

It is the materiel factor which has been given such tremenduous impetus by the Aberdeen exercises of the three years last past. The predicting interval (time of flight plus dead time) has been greatly decreased by attacking its two component parts. The continuous fuze setter, of recent development, has reduced the dead time from its war-time figure of 8 seconds to a more satisfactory one of about ½ second. It has disappeared, practically, from consideration. The time of flight has been reduced by increasing the muzzle velocity from about 1700 foot-seconds, as exemplified by the 75-mm. antiaircraft gun, to the values of 2600 and 2800 foot-seconds now in use—with at least 3000 foot-seconds in the not-too-distant future. This improvement in time noted in materiel developments since the war may be visualized more readily by showing, in figures, the extent of the gain effected. Specifically, let us compare the

75-mm. gun, with a muzzle velocity of 550 meters per second, firing H. E. shell armed with the 24/31 fuze, with the 3-inch, 2600 foot-second, M-1 gun, firing H. E. shell armed with the Mk. III fuze. Assume a vertical circle struck with a slant range of 6000 yards from the gun. Then the following tabulation will show the time-of-flight differences of the two guns at that slant range and at the various altitudes listed:

Altitude yards	*Time of flight seconds* 75-mm. gun	*M-1 gun*	*Decrease in time of flight seconds*	*per cent*
5500	27.0	14.0	13.0	48
4000	23.8	13.8	10.0	42
2000	21.2	13.5	7.7	36
0	19.7	13.2	6.5	33

If, to make the story complete, the two dead times be added so that predicting interval rather than time of flight is shown, the results would be:

Altitude yards	*Predicting interval seconds* 75-mm. gun	*M-1 gun*	*Decrease in predicting interval seconds*	*per cent*
5500	35.0	14.5	20.5	59
4000	31.8	14.3	17.5	55
2000	29.2	14.0	15.2	52
0	27.7	13.7	14.0	51

If the improvement in fire, as represented by these percentages, seems large, as indeed it is, consider further that our own 105-mm. gun, with a velocity of 2800 foot-seconds and a heavier projectile than the 3-inch gun, has a predicting interval that varies from about 10 per cent less at low altitudes to over 40 per cent less at high altitudes, as compared with the M-1 gun. In time of war the 105-mm. gun would be fired at 3000 foot-seconds which would result in still more of a decrease.

These enormous time improvements do not affect the probabilities of gunfire—they do affect vitally the probability of prediction. In time of war an aviator is not constrained to adhere to the predicted course and there is no power available that enables us to predict on the aviator's mind. However, the shorter the predicting interval, the less opportunity the aviator has to change his mind and his course before the prediction culminates in a group of bursts. For this reason the decreases in time mentioned above will be probably the greatest factor, in the event of war, in producing an increased number of hits over past records.

A second decided materiel progress is in the perfection of Case III methods of fire by means of follow-the-pointer dials for laying the gun in azimuth and elevation. Captain K. M. Loch, R. A., in his 1927-28 "Duncan" Gold Medal Essay (*Journal of the Royal Artillery,* July 1, 1928) states that "experts abroad regard it as a method at least 100% advance on any other." Captain Loch, an inveterate student of antiaircraft matters and a chronic winner of the "Duncan" essay, is cautious about going that far himself, but he strikes the nail squarely

on the head none the less. By the follow-the-pointer dials the accuracy of fire is increased directly through the increased accuracy of setting the firing data on the guns, as contrasted with the old sighting systems. This one feature is but a starting point in the ennumeration of advantages. There is the greater accuracy of following the target, the greater ease of putting the battery rapidly on target and holding it there, and many other advantages that enter in one way or another to increase the accuracy of fire and the certainty of firing. Let those officers who have fired, with gun sights, at a sleeve 7000 yards away in a haze, with a head wind blowing smoke and dust into the gun sights, and who, after waiting in vain for all four guns to report "on target," orders fire from half of the battery, only to loose the target from the firing guns on the first rounds—while the range section continues tracking—let those officers write a good definition of "certainty of firing" as here used.

In position finding, great advances in accuracy have taken place. The standard equipment now consists of the Director M-1 (Vickers) and the 4-meter stereoscopic height finder. In those instruments, the probable error of position finding has undergone considerable reduction.

The accuracy of fire of a battery may be gauged by the probable error of fire, which is the combination of the probable errors of the gun, of the height finder, and of the data computer. The probable error of fire, under average conditions and with the new materiel, is now about 80 yards in range along the trajectory. It is debatable whether or not it is desirable to decrease this figure, for it may be seen that a certain amount of dispersion is essential to absorb deviations in course of the target during the predicting interval and for firing at targets in formation. In other words, the nature of the target requires not a high percentage of hits but rather a high certainty of hitting. It is probable, however, that the gunnery end can be treated with greater success if the probable error of firing be reduced to a minimum and deliberate dispersion introduced if and to the amount found necessary. New clockwork fuzes and year-to-year improvements in propellants will reduce the gun probable error. The data-computer and height-finder probable errors are continually under fire and new instruments under design or already built should result in a diminution of these two figures. It is expected that the probable error of fire will be reduced shortly to about 40 or 50 yards.

Following this brief resume of the materiel situation in its effect on accuracy, we come naturally to a consideration of gunnery. It was the dictum of our French instructors, during the war, that "antiaircraft fire must be prepared—it cannot be adjusted." Their process of reasoning in arriving at that important doctrine was logical; their conclusions sound. Even today, with all our marked advancement in materiel and methods, the best we can do in revising that doctrine is to say that "antiaircraft fire must be prepared so that adjustment, which may be exceedingly difficult, will be unnecessary." Pages could be written on the pros and cons of adjustment, but it is not intended to enter that discussion here. Suffice to say that the fog is gradually lifting on the adjust-

ment question and adjustment of fire is possible, at least under certain conditions. In exactly what percentage of engagements it will be possible is a figure shrouded in the mists of futurity. To most proponents of adjustment it seems, quite logically, that (having prepared the fire) to continue firing at a target without result and with no attempt to adjust borders on inaction, an unforgivable military crime.

When we were told that antiaircraft fire must be prepared, with what problem were we confronted? A point in space must be selected and a series of bursts fired at that point, the location of each burst being computed and located by very *inaccurate means*. The deviation of the bursts, as represented by their determined C. I., from the point selected is due to the inaccuracies of locating the bursts; to errors in the firing tables; to non-standard muzzle velocities, caused by peculiarities of the powder lot, erosion of the gun, the temperature effort on powder, and other variants affecting muzzle velocity; to variations in weight of the projectiles; to elasticity effects; to wind; to drift; to rotation effects; to variations in density and in the moisture content of the air; and to any of the other causes of non-systematic error that might prevent the attainment of a true C. I. in the few rounds fired, or causes of systematic error that impel the C. I. to refrain obstinately from falling where it should. The summation of all these innumerable effects is a distortion of all trajectories, for which complicated changes, flat corrections made at one point in space, were supposed to offer a correction! It is true that something was known about wind and drift effects and approximate corrections for these two could be applied, but even if accurately applied, these corrections would be lost in the maze of the unknowns. The problem was incapable of so simple a solution then and is incapable of so simple a solution now.

The proper opening wedge to drive into this knotty question is one to reduce the most important ballistic variations to known and accurately applied corrections. The Director M-1 (Vickers) computes and applies its own wind and drift corrections. Muzzle velocity corrections may be effected by placing charts for the specific muzzle velocity obtained on the time-of-flight and altitude-fuze range drums. To determine the muzzle velocity developed the field chronograph has come into being and the Ordnance Department has caused to be published the differential effect of temperature on the powder.

A data computer constructed by the Ordnance Department, and now undergoing further development and perfection, is of such design that ballistic corrections are made with greater ease and accuracy than is true of the Director M-1. In addition to the automatic application of wind and drift corrections, muzzle velocity corrections may be made instantly by setting the desired value on a scale graduated in foot seconds. Furthermore, a ballistic coefficient correction is provided whereby the battery commander may take cognizance of variations in the ballistic density.

Quite a few sources of systematic error remain, but a large bite has been taken from the total number and the trial-shot problem has been reduced in complexity thereby. An extensive trial shot study has just been completed

which includes in its scope not only the most accurate means of applying trial-shot corrections that would be sensibly true throughout the varying conditions of fire, but also a practical field solution for the problem of locating the bursts in space accurately.

The subject of training in all its varied aspects, next in order for consideration, is one that is impressed on the soldier from his military infancy. It is unnecessary to dwell on training and its effect on accuracy here. There remains for examination the subject of opposition.

It has been stated that accuracy of fire is the result of innumerable small cogs running together to operate the entire machine. *Opposition* may be likened to the sand which an enemy will throw in those cogs. It has been told of a duelist who prided himself somewhat as a pistol shot, that he was wont to remark that he could break the stem of a wineglass at twenty paces. He was reminded that the fact of the wineglass being unable to shoot back must be given full consideration. So it is with the antiaircraft (or any other) battery. It is one thing to fire calmly at a sleeve target towed by a friend. It is quite another thing to fire when one or a score of enemy planes are buzzing around spitting lead at the battery. The same is true of the pilot, of course, who cannot be expected to bomb or machine gun with the same accuracy under fire as under target practice conditions, but that is beyond the scope of this paper.

It may be accepted as a fact that antiaircraft accuracy has made great advances since the war. It may be accepted equally that these advances have not passed unnoticed by air officers the world over. To think otherwise would be to underestimate a possible antagonist—a process frowned on since time immemorial. Whereas in the past the aviator has considered avoiding antiaircraft fire by defensive means, he is now contemplating the offensive. We may be assured, if the antiaircraft defense of the future proves as effective as its followers believe, the offensive will be a violent one indeed.

The defensive protection available for aviators includes, first of all, the avoidance of defended areas. It would be foolhardy in an aviator to fly near a group of antiaircraft guns, *unless his mission carried him there.* The bombardment plane, for example, must meet antiaircraft guns eventually if it is to attack a target of any consequence, since all such will be defended, but it need not fly through several other defenses en route to its objective if a course can be mapped to avoid them. Any change in speed, altitude, or direction of flight is a defensive measure, as is the judicious use of clouds, mist, or fog to screen air movements. Protective coloration and muffled motors fall in the same category. Unfortunately (from an air viewpoint) the necessity for adopting the more effective of these measures would prevent the accomplishment of some missions, delay the execution of others, and would be in any case a considerable nuisance. Furthermore, formation flying must be protected, and such flying, in the face of an unhampered antiaircraft defense, is going to be hazardous, to express it mildly.

The considerations of increased accuracy of antiaircraft fire and the objections that exist to defensive measures alone will put aviators "on the prod,"

to use an apt western expression. The excitement, nervous tension, curiosity, divided attention, and eagerness for immediate visible results always has and always will be present in combat to more or less degree. It should not be confused with fear. The effect is intangible. By training, by simplification of the gunners' tasks, by careful emplacement, by the maintenance of a high morale, and through experience, the effects of opposition may be minimized. Possible forms of opposition and the necessary counter measures will be considered at various points throughout the remainder of this discussion.

Let us now return to the original maxim, from which we have deleted the word accurate:

An efficient battery is a battery
(1) *that can be moved in time to the proper firing position*
(2) *with sufficient ammunition*
(3) *and can remain there*
(4) *and be prepared to deliver fire*
(5) *on the proper targets.*

As thus arranged, the attributes of an efficient antiaircraft battery may be considered in detail.

(1) *that can be moved in time to the proper firing position*

We are concerned here with the question of mobility. The dictates of the selection of the proper position will develop naturally with the consideration of other attributes.

A surprising number of people visualize a mobile antiaircraft battery as a thing of great similarity to a fire department, dashing madly across the country to meet a reported plane, perhaps firing as it goes, and returning to its lair at the conclusion of the festivities. The picture is, of course, erroneous. The antiaircraft battery is not concerned with putting out a fire; rather its function is to prevent the fire from starting, to continue the comparison, and its mobility must be greater and of a different sort than that of the fire-fighting vehicle. The mobility of which the battery must be possessed is of two kinds: march mobility and cross-country mobility.

The march mobility of an antiaircraft battery has to be of a high order that it may accompany and defend troops—even mechanized troops—on the march. To accompany the troops requires only a parity in mobility between the two, but to defend the accompanied units demands much more in the antiaircraft battery. It is contemplated that about two-thirds of the defending units will be halted and prepared to fire at all times. The remaining third will be occupied with passing the column so that it may take up position at its head and be prepared to fire until the rear of the column shall again catch up with its position. To accomplish this maneuver of advancing the rearmost battery or batteries and to permit two-thirds of the defense to be in position for action at all times necessitates, in the antiaircraft battery, at least three times the speed of the defended column, and a safety factor above that is to be desired. Furthermore, it is evident that a given strength of defense can be maintained by fewer batteries if the mobility of the batteries be high. These

considerations entail an effective road speed of at least 8 miles per hour for defending foot troops and 15 miles per hour in the case of cavalry units.

It has not been easy to maintain the mobility of antiaircraft batteries at the desired figure, for the using service has been calling lustily for greater muzzle velocities and greater stability since the war. Conformity with these demands brings with it greater weight and, normally, less mobility for that reason. The new M-1 gun, a direct answer to all requirements, appeared on balloon tires, though it weighed about 19,000 pounds. With it came a commercial four-wheel-drive prime mover, also on balloon tires, that seems to be its proper companion. This vehicle (the Coleman 5-ton truck) has eight speeds forward and a speed range of from almost nothing to 35 miles per hour. The two together have averaged over 15 miles per hour in hilly country, during a trip of about 150 miles. The definite speed figures of the unit cannot be given until after more protracted tests, but it appears now that 12 miles per hour may be expected with confidence and over 15 miles per hour attained, at least for short periods if desired. This road speed affords the mobility desired in an antiaircraft battery.

At this point there enters a consideration quite beyond the power of the antiaircraft personnel to solve, as it is a function of higher command. Being provided with guns of sufficient mobility, will we be enabled to use that mobility on the roads? The commander charged with the organization of the march of a large force is confronted with an unhappy situation even in the most thoroughly developed districts. There aren't sufficient roads to go around. However, "where there's a will—." It is suggested that the commander who fails to provide for the movement forward of his antiaircraft units will find a way immediately subsequent to the first attack from the air on his column.

The cross-country mobility of an antiaircraft battery includes its ability to use inferior roads, to cross fields, sandy or muddy stretches, shallow ditches and, in general, to go to the exact place where its presence is desired without regard to the intervening terrain.

It is not a very great exaggeration to state that the new unit (prime mover and gun) may disregard roads entirely when speed is not vital. The unit is not amphibious and cannot fly; it cannot climb trees or penetrate swamps; but it can meet any other test of mobility within reason. The balloon tires of the gun and prime mover, together with the speed ranges and power of the prime mover have produced this result. The service is familiar with the 1918 gun, which is equipped with solid tires, and with the present F. W. D. prime mover. To obtain a direct comparison of the old and new units, in recent tests, the new unit was maneuvered successfully through a soft field. The old unit failed at the edge of the field. The new prime mover then made the attempt with the old gun, and failed, and the new gun suffered the same fate coupled to the old prime mover. At the time of this test the M-1 gun weighed about 19,000 pounds and the new prime mover was loaded with 5000 pounds of ballast. Since then, the M-1 gun has been lightened materially by the substitution of

duralumin outriggers for the cast steel outriggers of the pilot mount. It will be recalled the 1918 gun weighs slightly over 14,000 pounds.

It seems that experience gained so far with the new mobile unit warrants the conclusion that it can be placed where it is needed at the time it is needed, even over very difficult terrain.

(2) *with sufficient ammunition*

The nature of the target that must be engaged has led to higher muzzle velocities and greater rates of fire. These attributes form the basis of sound gun design. The first characteristic entails heavier and bulkier rounds and the second necessitates an increase in the quantity that must be supplied. The two together add greatly to the complication of this phase of logistics. We have been given better guns, but the problem of ammunition supply has become, thereby, more difficult of solution.

This may be viewed from a different angle than that suggested above. It might be claimed that the greater efficiency of the weapons arising directly from the increased size of ammunition will result in an augmented defensive result from the firing of a smaller number of rounds than was necessary formerly to accomplish a given end. This assumption leads to the conclusion that the overall expenditure of ammunition, by weight or volume, throughout a campaign, would be about on a parity with that of the World War. This is interesting to consider and logical, so far as it goes, but it does not present a complete review of the question. The air activity of another war would be far more intense than that of the past conflict and antiaircraft batteries would be in action more frequently.

What shall be prescribed as a days allowance of ammunition? In the French antiaircraft service, during the war, it was deemed advisable to maintain the battery supply at 1000 rounds per gun. That such an allowance was ever fired in one day seems unlikely, but in the stabilized situation then obtaining, the maintenance of a supply of this size offered no insuperable difficulties, and it allowed a margin of safety against possible interruption to the service of ammunition supply. Now, however, we are confronted with four gun batteries instead of two, and with ammunition roughly twice as large as the 75-mm. ammunition. Using the same figure of 1000 rounds per gun we should be required now to maintain 4000 rounds at the battery. This amount of ammunition, boxed, comprises the load of 32 of the present ammunition trucks. Thus, but one-eighth of the total allowance could accompany the battery in its fifth section (of four trucks) or, if the battery share of the combat train's twelve trucks be included, a maximum of 1000 rounds, the allowance for one gun, could be carried with the battery. It will be recalled that the combat train may be subdivided and the ammunition sections accompany the various batteries at the discretion of the battalion commander. Either the figure of 1000 rounds per gun is excessive or the number of ammunition trucks available is insufficient.

Let us examine into the firing time represented by 1000 rounds per gun. The M-1 gun has a prescribed rate of fire of 25 rounds per gun per minute. The

battery should fire 100 rounds each minute of action and 4000 rounds represents a battery firing time of 40 minutes. While a total action time of this magnitude may be encountered in times of a hostile attack of importance, the figure is probably high to be used as an average. Generally, an individual action should have a duration of less than a minute. It should be terminated within that time for one of the following reasons:

(a) The target is damaged or destroyed
(b) The target passes out of range
(c) The target becomes obscured

If the target adopts defensive flying—which is likely—this by no means signalizes a termination of the action, but the battery commander should adopt volley fire at once, thus decreasing the ammunition expenditure. If the attack be made by a force of considerable size with a will to proceed regardless of losses, then the action will not be limited to any figure. We should except from this time limit, also, the high-flying pursuit plane until such time as more is known of the results to be expected in the highest regions. In the light of present knowledge, and considering the average condition, it seems reasonable that the battery commander should so adjust his fire within a minute as to cause termination of the action or to enforce defensive flying on the aviator. If this be true, 4000 rounds represents some sixty engagements throughout the day—a not inconsiderable day's work.

Some authorities favor prescribing a day's allowance of 300 rounds per gun. This is within the carrying capabilities (approximately) of the present assignment of transportation. The total of 1200 rounds represents a battery firing time of twelve minutes and some fifteen to twenty individual engagements. This, certainly, does not allow any factor of safety.

The situation will be improved somewhat, if the new gun prime mover be assigned for duty in ammunition haulage, which is a logical corollary since the mobility of the ammunition must be equal to that of the guns. Instead of carrying about 125 rounds per truck, these vehicles may be loaded with about 225 rounds. Thus 900 rounds may be carried with the fifth section and 900 more with the battery section of the combat train. Surely we can squeeze 200 more rounds in and say that 2000 rounds can be carried with the new batteries equipped with the present number of ammunition trucks, and that they will be able, thereby, to fire for twenty minutes or to participate in some thirty engagements. This figure seems a reasonable one.

If the estimations and deductions used herein have not been incorrect, the ammunition situation may be summarized somewhat as follows:

(a) There should accompany the battery, in its own and the combat train vehicles, a total of 2000 rounds. This may be accomplished if the new vehicles recommended for antiaircraft use are issued in the same numbers as now allowed.

(b) In times of impending enemy attack the battery supply should be maintained at 4000 rounds.

(c) Mobile batteries temporarily demobilized by being assigned to the

defense of important utilities not likely to be moved by fluctuations of the battle line should be allowed 4000 rounds at the guns.

(3) *and can remain there*

It has been charged that the antiaircraft gun is developing its offensive power to the neglect of offensive action that may be taken against it and to the detriment of the probable efficacy of the battery. Certainly there is some truth in the accusation. How many batteries, in training, have prepared complete positions? How many have been fired from any but an exposed position without attempt at concealment or protection? The impetus given to antiaircraft development by the Aberdeen tests has been tremenduous and it is undoubtedly true that the striking power of the weapons has forged far ahead and that defense has been neglected. However, one thing at a time! The improved weapons are a fact. It would be well, now, to devote time to insuring that a good battery, once emplaced, can remain there, for certainly no striking power can come from a destroyed gun and very little from a gun always on the move. For various reasons the Aberdeen tests could not have been held with equal success elsewhere. This is not so of defensive tests. The batteries in service should be studying and practicing the art of protection in all its many phases. It has been stated elsewhere in this article that a future conflict would find air units decidedly "on the prod" where antiaircraft is concerned. Now is the time, in conjunction with our own Air Corps, to discover the probable nature of the air offensive action and the best answers thereto. The two arms should maneuver together to the end that our own planes would be in minimum danger from hostile antiaircraft and hostile planes in maximum danger from our own antiaircraft.

The most efficient antiaircraft battery, in respect to the attribute now under consideration, and which may be called permanence, is one that remains in position and can fire during the entire duration of the tactical siutation that requires its presence in that site. It lacks permanence, within our meaning of the term, when the guns are destroyed or damaged, whether through artillery or air action, when the position is rendered untenable from the same causes, and when the guns become too worn for effective firing.

The last-mentioned factor has been solved admirably, in the new antiaircraft guns, by the inclusion of the removable liner in its design. High velocities entail rapid wear. Rapid wear, without some solution like the removable liner, means loss of firing strength while guns are being re-tubed at Ordnance repair parks. The removable liner may be changed by the personnel in the field without special tools and an old gun metomorphosed into being a new gun in about half an hour.

Loss of permanence through artillery fire is a subject continually brought to the attention of the artilleryman, antiaircraft or otherwise. The antiaircraft battery is likely, in a future conflict, to occupy an unenviable position of prominence. In the face of a projected enemy drive, it is very possible that the enemy high command will pass down word to his artillery staff that the opposing antiaircraft batteries must be put out of action for the greater ease of

accomplishing the air missions incident to the drive. Since there are but three batteries within each Corps, normally, each battery may be the recipient of a not inconsiderable bit of violent attention from the artillery across the line. For a well known receipe, however, we are advised to "first catch our rabbit." The battery must not be seen. Here comes the first rub, for an antiaircraft battery, by the nature of its mission, is compelled to fire at the one time when the disclosure of its position is most likely—when hostile observation planes are above. The task of the observation plane must be rendered most difficult by the selection of the site for the battery and by concealment and protective emplacing.

It is not intended to enter into the tactical considerations behind the battalion commander's selection of position. Rather are we concerned with the battery commander's survey of the terrain. The battery should have, approximately, a firing field from 0°to 90° in elevation and 360° in azimuth. The qualifying word allows for the difference between the ideal site and the one that caution and a regard for permanence dictates. Certainly a battery must not be under direct observation from possible ground stations within enemy territory and the lowermost 15° or 20° elevation toward the enemy must be sacrificed in the interest of defilade. The 360° traverse cannot be sacrificed unless the exigencies of the situation force a battery into position in woods, a village, or elsewhere where 360° is not attainable under any circumstances. It should be recognized, in so siting a battery, that its efficiency is impaired thereby. It is essential that possible registration points be avoided. It is no longer necessary that the position be on or near a good road, due to the cross-country mobility of the new guns. In fact, it would be well to avoid roads as being likely sources of fire and of interfering noises.

Consider, next, the possibilities for concealment. The model 1918 gun is as difficult to conceal as a gun may be without special efforts in that direction. It projects up out of the landscape like a lighthouse on the shore. The M-1 gun, when emplaced, squats down nicely on the ground, has a low trunnion height, and lends itself readily to concealment. The best possible terrain is that covered with scrub growth rising to the height of the trunnions. The outriggers, which stretch out like a spiders legs, will be covered by the natural growth. To each gun must be attached a camouflage framework, sufficient in extent to cover the gunners' platform and free to revolve with the gun. Natural materiel on the framework, frequently renewed, will produce the best results. The framework must be so constructed that the gun elevates in a slit left for that purpose, the slit being closed by a flexible strip of the camouflage materiel which will follow the movements of the gun in elevation or depression. Vision from the gun emplacement need not be provided in case III installations.

The foregoing is far from being a complete survey of the subject of camouflage, but it furnishes a brief reference to the peculiarities of the antiaircraft situation which will not be found in published regulations dealing with camouflage. An antiaircraft battery can be concealed and fired without detection,

particularly in the maze of artillery in action during a battle. The permanence of the battery depends on it.

Concealment is but half the story. The guns must be emplaced with the idea in mind of their eventual detection, and every precaution taken to protect men and materiel alike. A sandbag wall surrounding each gun is the most ready form of protection. It is the least that should be done. A better solution may be found in emplacing the guns on a slope and digging in so that the guns are mostly below ground level on three sides. The fourth can be closed by sand bags. Let the battery commander exercise his ingenuity in accordance with the terrain available to him. With the guns securely installed and the range section practically below the level of the ground, the battery may be made secure except against a direct hit. When every possible precaution has been taken and the battery commander feels that he may remain in position forever, then is the time to prepare an alternate position ready for immediate occupancy. The defended elements expect continued antiaircraft protection and they must be afforded continuous protection. To be caught napping with nowhere to go is inexcusable.

The foregoing assumes that time for the preparation of the emplacements is available. Often this will not be the good fortune of the battery, and occasions are not difficult to conceive where the battery must dash from the road and be ready to fire in a minimum of time. Even then, a judicious use of the terrain for concealment still affords the battery commander an opportunity to give his command a goodly measure of protection. The situation in which a battery cannot be allowed time to complete its emplacements is probably one in which it will not be required to remain in the position long—as in the case of the protection of troops on the march—and destruction by artillery fire, or from the air either for that matter, has less likelihood of happening.

In so far as the actual construction of an emplacement is concerned, consideration of possible air attack on the battery should lead to exactly the same construction as that designed for protection against artillery fire. If a battery be given every possible protection against terrestrial fire, then nothing more can be done, by emplacement construction, to protect it from the air. Overhead protection is not practicable, and a direct bomb hit will have the same disasterous effect as a direct shell hit. Bomb fragments, most to be feared from the air, are guarded against, in so far as may be, by the protection against shell fragments. If the attack be delivered by machine guns, then the defense must be by the same weapon, which, in this particular sort of duel, is not at a great disadvantage because of the great mobility of the attacker. Let it be noted that to machine-gun the battery the plane must approach to within accurate range from the machine guns of the battery. If the plane maneuvers so as to be a difficult target for the ground machine guns, that same maneuvering renders the battery a difficult target for the plane to hit. If the plane comes within range of the machine guns for but a matter of seconds, then, in turn, it can be machine-gunning the battery but a matter of seconds. In a machine-gun

duel, the battery can take its chance, gun against gun, but against the bomb it must protect carefully by emplacement.

This is an antiaircraft gun treatise and, in introducing the machine gun therein, the reference is to the machine guns assigned to the gun battery for its protection and hence an integral part thereof. At this point we must digress a moment to survey, briefly, the antiaircraft defense as a whole. It is not presenting a true picture to consider a gun battery alone, as is being done here, for the antiaircraft regiment with all its components works for a common end. Thus, when we visualize a formation of attack planes skimming over the trees to attack a gun battery, let us visualize at the same time the continuous deep band of machine-gun fire that must be penetrated before the gun battery is reached. When a picture is drawn of an artillery regulation plane or of bombardment planes maneuvering to direct fire on or to attack a gun battery, let us not loose sight of the other batteries of guns and 37-mm. cannon that may bear on the same target at the same time. If a plane is obscured by the sun from one battery, it cannot be so obscured at the same time from all the others, and while intermittent clouds may hide a plane effectively from one position, that target may be presented clearly to the remainder of the defense. If we proceed, now, with an examination of the gun battery alone, it is with this truer and more complete picture in the background.

Direct action against the gun battery from the air may assume one of two forms, according to present knowledge; the attack may be delivered by bombardment planes or by attack planes. Probably the first may be discounted as being a very inefficient form of attack as viewed from the side of the hostile air force. The bombardment plane is a valuable and indispensable element in the air scheme of things, and should be sacrificed only where the possible gains are estimated to be commensurate with the possible losses. Such is not true, normally, of an attack on an antiaircraft battery. From the altitude at which the bombardment plane must operate to minimize the effect of fire from the ground, the antiaircraft battery is a target of really minute size and the probability of hitting thereon too small for any hope of great success. The bombardment plane will reserve its power for more appropriate targets.

It is from the attack plane that the antiaircraft battery may anticipate the greatest attention. The attack plane is relatively new to the air troops themselves and it is to be hoped that any inaccuracies in speaking of its tactics will be condoned. We may visualize the great air attack of the future as being delivered by the bombardment plane, with pursuit craft in protection above and the attack plane fulfilling the same mission below. During the delivery of the bombardment and in preparation therefor, attack planes will swarm over the countryside, seeking whom they may devour and making the air safe for their larger friends above.

The attack plane is to operate just above the tree tops. It is to appear suddenly before its target and swoop down thereon, one followed by another. A determined attack of this nature is not lightly to be passed over. Let us examine the possible counter measures.

(a) We are again reminded that one must "first catch his rabbit." Concealment is the first essential to success. In furtherance of this consideration, and bearing in mind that a battery destroyed is of no value, is it not logical to conserve that value by suspending action during the presence of the attack planes and thus avoid disclosing the position? If the attackers remain in the vicinity, returning again and again to the attack, such a course need not be considered, since the position is evidently known. In this case the battery should remain in action against the most important target present, whether the attacking planes themselves or another formation. The case of a formation of attack planes passing by in such a manner that there is little likelihood of hitting them with the guns, or when more important targets are aloft, may be regarded differently. Would it not serve the mission of continued defense best to lie "doggo" during the few seconds the attacking planes are passing and then resume activities? There are many pros and equally many cons. The answer should be found through extensive maneuvers.

(b) Avoid surprise. In siting the battery careful consideration must be given possible lines of approach for attack planes, and their ability to appear suddenly from over the trees or over a hill nullified. Where it is essential that a position near hills or trees be taken, then outpost listeners and outpost machine guns are vital. It has been stated, for example, that defilade from the enemy observation posts is necessary. The top of the hill forming the desired defilade must be the site of one of the battery machine-gun posts. Surprise is no less excusable in antiaircraft troops than in any other.

(c) The machine-gun training and organization must not be entirely subordinated to the gun training and organization. The machine gun is considered as secondary armament when assigned to the gun battery. Its importance should be equal to that of the guns for through the machine gun the guns will be enabled to continue their normal functions and the machine guns are forming a part of the entire defense scheme while they are protecting the guns. The strength and accuracy of the machine-gun defense of the guns should be such that attack planes cannot operate against the gun battery without very heavy losses. Note that the machine guns, dug down into their snug little holes, are as nearly immune from damage as a firing element may be. In the light of the new attitude of airmen toward the antiaircraft gun, it is not unreasonable to double the number of machine guns assigned to each gun battery. We must guarantee the permanence of the gun in position for the benefit of the entire personnel and materiel of the corps.

Before passing from the question of permanence and, of air action, it is desired to mention a possible form of air defense for the protection of the bombardment plane. It has been suggested that the perfection of smoke of the same weight as air and of the apparatus for laying the smoke from a plane has added another means for guarding the bombardment plane. It is proposed to lay screens of smoke between the gun batteries and the planes to be protected. Naturally, if the screens are properly placed, this would form an effective protection, for the batteries are not now prepared to fire at unseen

targets. If we disregard possible damage to the smoke plane, there remains the interesting task of interposing screens, in a wind, between three or more separate batteries and a constantly moving bombardment formation. The word impossible should be used with great caution in the present day of development, so let us confine ourselves to remarking that it appears to be a most difficult undertaking. The full possibilities of such a scheme could be developed in combined maneuvers.

(4) *and be prepared to deliver fire*

For a battery to be prepared to deliver fire, it is necessary that the emplacement and organization of the materiel be completed and that the personnel be on the alert. Both of these considerations have been treated somewhat in the pages preceding.

Between the desired extreme of completing a thorough emplacement before a round is fired and the often necessary other extreme of firing practically from the road, there are innumerable situations that may be met. We shall consider, briefly, the two extreme cases.

Very little need be added to what has gone before in respect to emplacement. Of several possible solutions to a march problem, for example, the regimental or battalion commander should favor that decision which most nearly affords the battery commander the time he needs to prepare his emplacements. We should now, throughout the service, set about discovering how much can be accomplished in a given time under different conditions of terrain. Carefully planned terrain exercises with full war strength and equipment are needed to furnish the antiaircraft commanders, present and future, the materiel with which to work in making their decisions.

The other aspect of emplacement, the actual maneuver of the gun, is a materiel aspect entirely. The specifications for an antiaircraft gun, as presented to the Ordnance Department, called for a highly mobile gun of at least 2600 foot-seconds muzzle velocity, with all-round fire and capable of rapid emplacement. The difficulty of applying all these desirable characteristics to one mount may be imagined, for an improvement in any one of the lines of development renders the task of advancing the other lines just that much more difficult. In the M-1 gun we find a well-balanced solution. This gun can be emplaced in almost any terrain in from seven to fifteen minutes. The companion range instruments can be set up while the guns are being prepared. Connections of the data cables should be completed by the time the guns have been levelled and there remains the orientation of the battery before it is ready to fire. This process, using a star or other infinite point for paralleling guns and instruments and an ordinary compass for orientation, should occupy from two to five minutes. All in all the battery can be prepared for firing in from fifteen to twenty minutes by trained personnel working against time. Naturally, one would like to see a battery that could be fired as soon as halted on the road, but we can't have everything, and the other requirements must be met. Fifteen minutes is a satisfactory figure.

The preparation of the personnel has been discussed under the caption "avoid surprise." An airplane does not materialize out of space. It flies to the point where it is discovered, and its physical progress may be noted. In addition to its normal watchmen in the battery command post, there must be the outposts mentioned before, to guard against surprise from low-flying planes. Each battery serves as an outpost for all batteries to the rear and for air units as well. The entire antiaircraft service should be organized so that, in the normal course of events, the approach of a target is known long before it comes within sight or hearing. Clouds render this ideal situation difficult of attainment, but they make the work of the antiaircraft intelligence service even more important, since only a fraction of the reports possible in clear weather can be made and each report is enhanced in value, relatively.

The consideration of this question is particularly interesting with reference to the defense of troops on the march. It is to be supposed that troops on the march will not normally be penetrating a zone of well-organized antiaircraft defense, but rather will be marching with their own defending units accompanying them. Surprise from the air might be disastrous to the marching troops. Is it not logically a function of the antiaircraft units, trained in the identification of aircraft, to prevent such surprise? The advance, flank, and rear security units of the marching body must have their counterparts in antiaircraft security units who, by pyrotechnic or other signals, afford to the troops time for self protection and to the defense units time for alerting the various batteries.

(5) *on the proper targets*

To be able to fire on the proper target entails that the personnel of the battery can see it, can recognize it for what it is, and that, of several possible choices, the battery commander shall know which target to engage.

It is unnecessary to dwell long on the subject of identification of aircraft. It is an art which must be practiced assiduously before a man may qualify as an observer. Gunners' instruction furnishes the foundation, but how many qualified gunners can identify correctly even the more common types of aircraft? Not only must the battery observers be capable of naming the nationality, type, and model of any plane at a glance, in time of war, but they must be able, as well, to determine the nationality and type from sound alone. In times of peace it should be routine in a battery that a corps of observers be available for use in tactical problems. Without qualified observers it may be impossible to obtain the maximum benefit from maneuvers embodying the use of different types of planes.

Selection of the target to engage is usually a function of the battery commander. In the normal situation he must act on his own initiative because of the lack of time in which to refer questions to the higher commander who may have a better grasp of the situation as a whole. For the exercise of this initiative the battery commander must be prepared by training in the principles of fire tactics. In time of action, or assumed action, he must be given a definite mission and his course of action thereafter must be first of all toward the successful accomplishment of that mission. Without attempting to lay down a

series of tactical principles, let us develop the problem further by assuming situations and making the battery commander's decisions.

(a) A battery assigned to the defense of a column on the march. A formation of bombardment planes is paralleling the column about three miles away. A formation of attack planes is approaching the column. The attack planes endanger the column immediately and must engaged first.

(b) A battery assigned to the defense of a corps in position. A major air offensive has been planned and a huge air force is being assembled in the air behind the lines. Higher authority assigns to the antiaircraft first consideration for this air force. Two large hostile formations approach, one of bombardment planes and one of pursuit planes. The pursuit planes should be engaged first and every effort exerted to break up the formation and otherwise decrease their effectiveness against our own air units. It might be reasoned that the air force being assembled will have pursuit strength sufficient to guarantee the success of the operation. This would have been considered by the authority that issued the order and he has decided to close every possible source of loss to the force in question. While the hostile pursuit formation may not endanger the success of the operation, it could destroy some of the planes participating therein and thus decrease the strength of the blow.

(c) A battery assigned to the defense of a railhead. Pursuit and bombardment planes approach. The bombardment planes should be engaged first.

(d) A battery assigned to the defense of a corps in position. Pursuit and reconnaissance planes approach. The latter offer the greatest immediate danger to the corps, through artillery regulation or photography, and should be engaged first.

In these assumed situations each of the four general types of aircraft have been severally selected as the proper target to engage. It is not believed that the situations are far fetched nor the decisions illogical. It will be noted that no mention has been made of the size or maneuverability of the planes, nor of their particular presentation to the battery. Such factors cannot logically be governing when the essence of the battery commander's decision must be invariably the accomplishment of his mission and *not the building up of a high record of planes hit.* Before battalion commanders can take up the training of their battery commanders uniformly, in this regard, there is need for a clear and concise set of doctrines of antiaircraft fire tactics, tested, where necessary, by field maneuvers.

In one form or another we have discussed the major attributes of an efficient antiaircraft battery. An effort has been made to indicate those attributes of which our batteries are now possessed and those which require study, test, and field maneuvers for their further development. It has been claimed, in this article, that the antiaircraft battery is now an efficient battery—but even the most efficient battery cannot fire in two directions at once. The situation should be revised boldly and the tables of organization altered to allow more antiaircraft batteries to the corps.

Spotting and Plotting for Antiaircraft Artillery

From the Aberdeen Tests

I. Observation of Bursts

1. *Method of Measuring Deviations. a.* The problem of measuring and recording the position of the bursts of antiaircraft gun fire with respect to the target is of primary importance. The first method used in our service provided for measurements in range and in vertical deflection by means of a grid held by the observer in the towing plane. The observer was supposed to record his observations on specially prepared cards. Lateral deviations were read by observers on the ground. This system was hopeless. The aerial observer could never obtain but a small percentage of the bursts, recording was very difficult for him, and the synchronization of his results with those of the ground observers was impossible.

b. At Aberdeen during the antiaircraft tests a complete ground system was installed. This year two methods of obtaining deviation of bursts from the towed target were used; these were the camera method and the visual method. Since these two systems used approximately the same base line and the same orientation data, the deviations obtained by each could be compared. The course of the target could be plotted and results from each system computed. The two systems provided a check against each other, made certain that a course would not be lost should one system fail for any reason to obtain deviations, and permitted of a comparison as regards accuracy and the ability of each system to observe under various conditions of visibility and dispersion. For further data on comparison of visual and camera system see paragraph 14 of the Final Report, Antiaircraft Firings and Tests, Aberdeen Proving Ground, Maryland, 1928.

2. *The Camera Method. a.* The apparatus used in this method consists of two Bell and Howell B motion picture cameras, each mounted on the modified base of an azimuth instrument, M-1918. To the trunnion carrying the camera is attached an elbow telescope M-2 whose line of collimation can be made exactly parallel to that of the camera. Each camera is normally operated by a small motor and the two camera units are synchronized by means of a relay circuit closed approximately every second by means of a clockwork. A small electric lamp in the relay circuit marks the film of each camera at the same time as often as the relay circuit closes. One projector and the necessary developing and drying equipment are necessary in the laboratory. Specially prepared grid screens laid off to the proper scale for projecting the film are also required.

b. In use a camera unit is set up at each end of a base line whose length and azimuth is accurately known and the necessary telephone and synchronizing

circuits installed and connected. Each camera is accurately pointed at the target during the firing by means of the elbow telescope and pictures are taken of the bursts. The azimuth of the first and last bursts are read and recorded at each station. The film is then taken to the laboratory, developed, and projected from a projector onto a specially prepared grid screen from which the deviations in mils from the target can be read directly. The film from the camera at the battery position is measured for the mil deviations right or left and above or below the line of position to the target. The film from the camera on the flank position is measured for the mil deviations right or left only. The synchronizing device mentioned before provides a means of insuring that a given burst measured from the battery position is the same burst as measured

FIG. 1

from the flank position. For further information on camera see Section II, paragraph 14, and Appendix IV, Section A, Part 16 of the Aberdeen report.

3. *The Visual Observation Method.* *a.* This method is substantially the same as that used at Aberdeen Proving Ground last year and at various other stations. Two instruments are used, one at the battery position to observe lateral deviations (right and left) and vertical deviations (above and below) and one at a flank station to observe longitudinal deviations. As the instruments were located here so that the flank station was in prolongation of all courses, its results were overs and shorts though it is not necessary, to insure the success of the system, that this condition exist. It is however desirable.

b. The instruments used (Figure 1) consisted of two model 1920 antiaircraft telescopes each fitted with a cross arm which carried at each end a model

1917 gun sight. Each sight was so mounted that it could be adjusted in any direction and its line of collimation made to coincide with that of the training instrument. On the observing instrument (Figures 1 and 2) at the battery position one of the sights had the reticule turned through 90° so that vertical deviations could be read from it. The instrument at the flank station permitted of reading overs and shorts from either gun sight but as the magnitude of these deviations was usually much greater than those from the battery it was found better to have one observer read lines and shorts and another read overs.

c. To operate this system of observation it was necessary to devise a method of synchronizing the readings from all three observers. This was done by running two telephone lines from the battery observing instrument to the flank

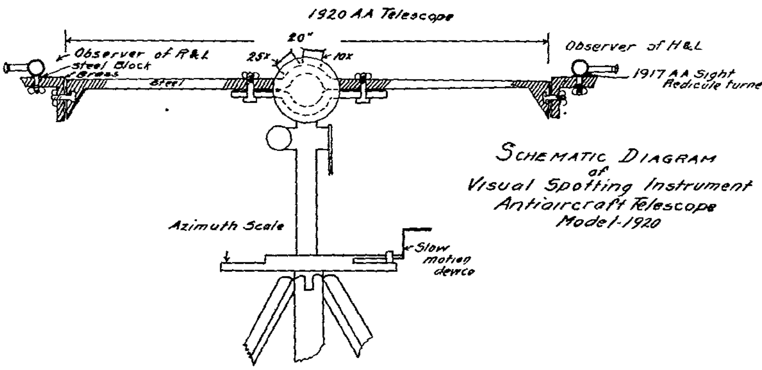


FIG. 2

station where the synchronizer (Figure 3) was located. This instrument consisted of a box containing two rollers on which was rolled a long piece of 40-inch tracing cloth, so that by turning the crank 1 (Figure 3) this cloth moved over the visible space at the top of the box and allowed the recorders to write the deviations received on the cloth. The observers at the battery observing instrument telephoned their observed deviations over their respective line to the recorders at the synchronizer who wrote them on the cloth as near the metal strip 5 (Figure 3) as possible. The logitudinal recorder received his deviations from the two observers at the flank instrument orally and recorded them as did the other recorders. Therefore, if all three deviations of a single burst were read and recorded simultaneously they would appear in a straight line along the tracing cloth of the synchronizer. This method of recording was much better than that employed last year when each observer had a separate reader who wrote down the readings as called by his observer and in so doing placed them opposite a figure determined by the time of burst. This time was indicated by a man with a stop watch who called seconds during the course. It is desirable to have the synchronizer away from the gun battery so that the recorders may not be bothered by the noise of gun fire. No difficulty was experienced in hearing and recording the deviations received over telephones.

One longitudinal recorder had no trouble in recording deviations received from two observers even though they did not prefix the words over or short to their readings since he could distinguish the observer by his voice. However, two longitudinal recorders could be used if needed.

After the course or the shoot was over, the cloth was turned back to the beginning and the deviations were read off and recorded on a suitable data sheet. Where a deviation from one station was missing from a line containing two others, that reading was considered lost. For a slow rate of fire (less than 50 rounds per minute) no difficulty was experienced in keeping the records

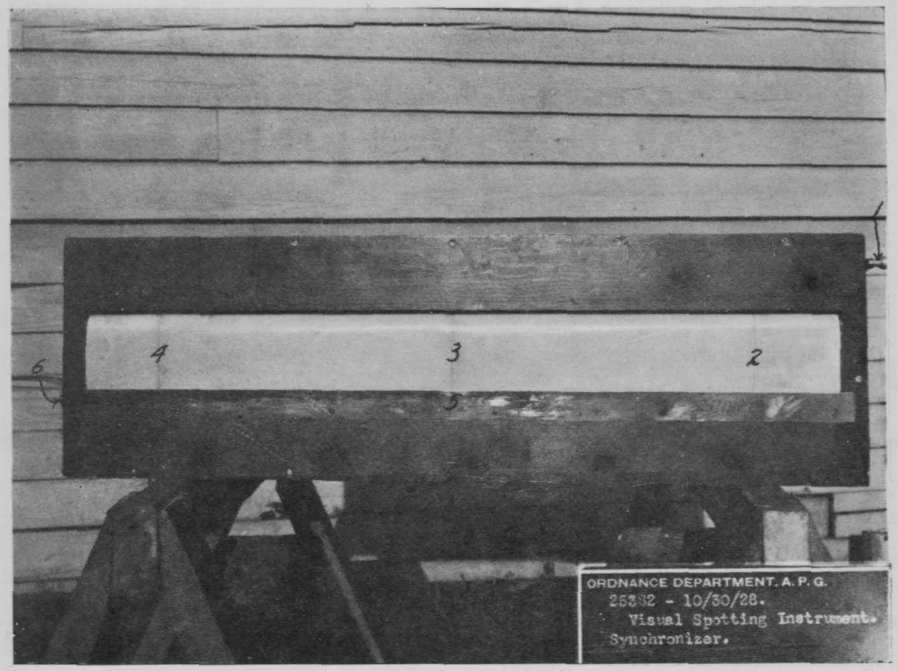


FIG. 3

synchronized, but above that rate a few bursts would be lost and a few would be out of synchronism. This was closely watched by comparing the visual results with the camera results, and in nearly all cases the synchronism would never be disturbed except for a few rounds.

d. To complete the data necessary for the final plotting and determination of hits, it was necessary that both observing instruments be carefully oriented before the firing and that an additional man at each instrument read the azimuth of the target at first and last burst or mark the plate of the instrument at these points and later reset the instrument and read the azimuths. These azimuths, with the direction of the course and number of shots fired, were recorded for each course.

II. Method of Plotting

1. *Introductory.* From the foregoing explanation it is seen that the same data are obtained from both camera and visual spotting units; *i. e.*, the deviations of the individual bursts and the azimuths of the target at the first and the last bursts, from each of the two terrestrial stations. From other sources the following data were obtained and used for the final plot of hits on the danger volume.

Altitude: obtained from the height finder.

Angular height: obtained from the height finder or B. C. instrument.

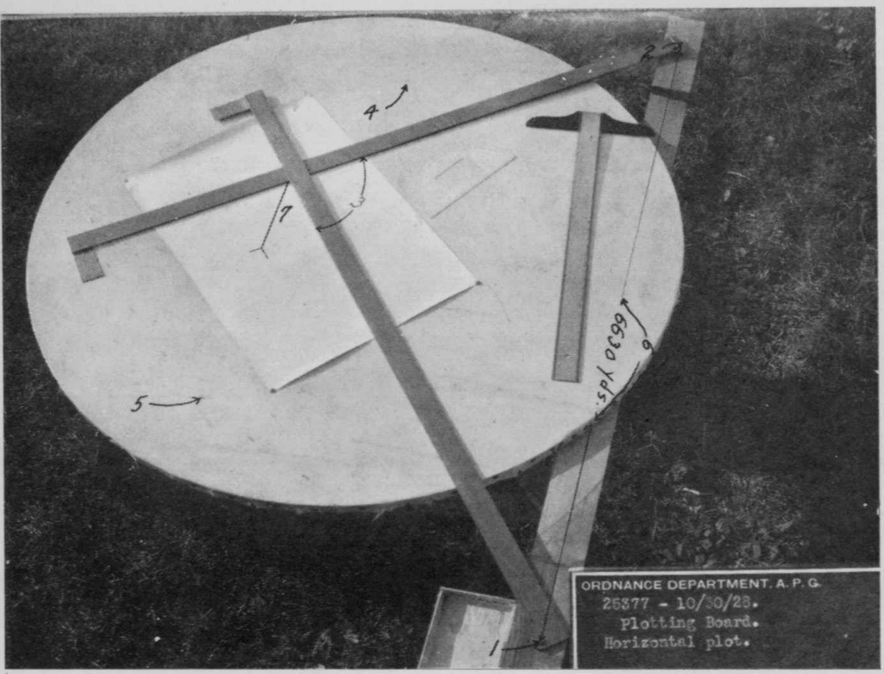


Fig. 4

2. *Horizontal Projection of Target's Course. a.* Having the azimuths of the target taken at the same instant from two accurately located stations, the horizontal projection of the target at that instant can be readily plotted.

b. For this purpose an improvised board with brass arms, one pivoted at each station, was used (Figure 4). The scale of this board was 1 inch equal to 100 yards. By use of the azimuth scales drawn on the board (4 and 5) the arms were laid at the azimuths of the target at the first burst and the intersection plotted. This, then, is the plot of the position of the target on the horizontal plane at the beginning of the firing on this course. Similarly, the position was plotted for the end of the course, using the azimuths of the target at the last burst. Assuming the target to fly in a straight line, a line joining these two

plotted points (7) is the horizontal projection of the target's course during the firing on that course.

3. *Horizontal Ranges and Mean Target Angle.* *a.* To plot accurately the position of each burst, it would be necessary to fix definitely the position of the target at the instant of each burst. This could be accomplished with an azimuth and angular-height recording device in the camera spotting unit as discussed in Appendix IV of the Aberdeen report. But without such a device, or when using the visual unit, only an approximate position can be determined. As a difference of one or two hundred yards in slant range or 10 mils in the target angle or angular height was found to make practically no difference in

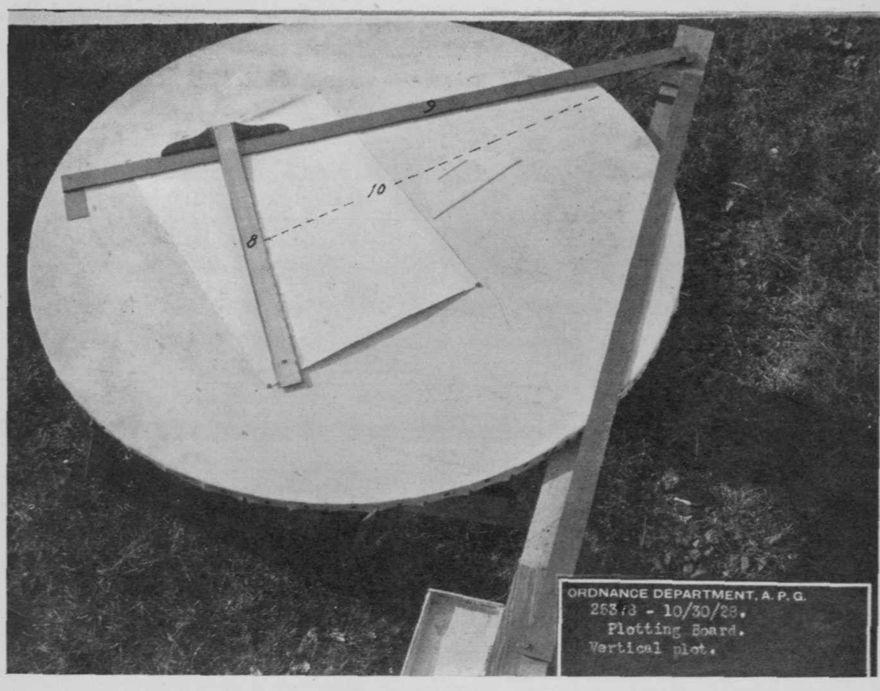


Fig. 5

the final plotting, it was decided to use the middle point of all courses or sections of courses as the mean position of the target. If the course was over 500 yards long, it was split up into sections and the center of each section taken as the target position. In this way much time and work was saved and the errors introduced by making the assumption that the target was at a mean central position on its course or section of course were much smaller than the errors involved in reading the deviations.

b. The brass arms of the plotting board were made to intersect at this mean point and the horizontal range from each station was read and recorded. The angle between the arms at this intersection, here called the mean target angle 3 (Figure 4) was read with a protractor.

4. *Slant Ranges.* *a.* As slant ranges from each observing station to the target were needed to convert mil deviations to yards, they were now plotted graphically, using the horizontal ranges just determined and the average altitude for that course as taken from the battery records. This was done on the plotting board previously described by setting a graduated T-square along one of the brass arms at the horizontal range 9 (Figure 5) and putting a pin into the board at the altitude 8 being used. The same arm was then swung over to this pin and the slant range 10 read off direct.

5. *Plot of Bursts in Horizontal and Vertical Planes.* (Figure 6.) Scale: 1 inch equals 50 yards.

a. By use of regular drafting equipment. (1) As some bursts were plotted by use of a scale and straight edge only, and that method will probably be used to some extent in the service until something like the xylonite plotter is issued or improvised, that method will be described first.

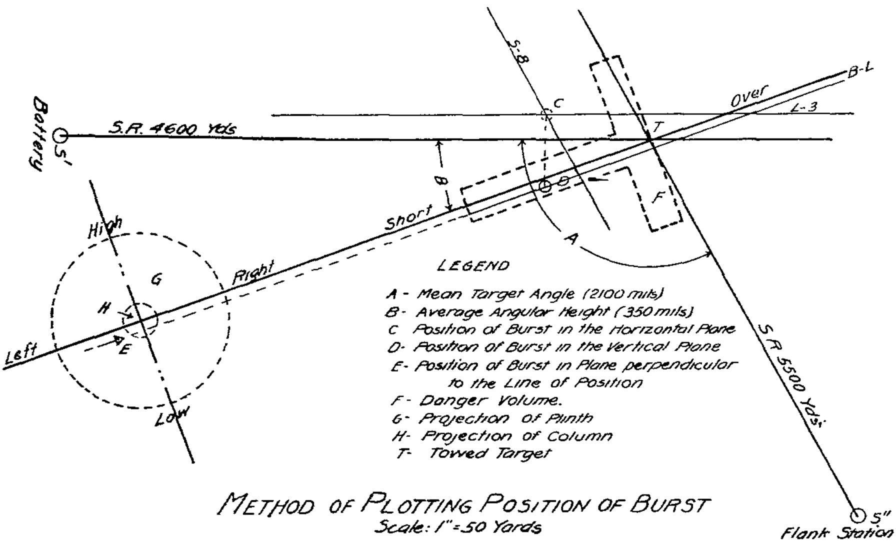


FIG. 6

(2) From a straight horizontal line $S'T$ (Figure 6), made to represent the horizontal projection of the battery target line, the mean target angle A was laid off at the target and $S''T$ drawn as the horizontal projection of the flank station target line.

(3) The lateral deviation in mils was converted to yards and this distance laid off perpendicular to $S'T$ in the proper sense, right or left. A construction line was drawn parallel to $S'T$ at this distance, which thus represents the horizontal projection of the line of sight from the battery station to the burst L-3.

(4) In the same manner the lateral deviation as observed at the flank station was laid off from $S''T$ and the construction line S-8 drawn. As these two construction lines are the horizontal projections of the lines of sight to the

burst from the two observing stations, their intersection *C* is the horizontal projection of the position of the burst.

(5) In determining the horizontal projection of the burst as just described, the plane of the paper was considered to represent a horizontal plane on the ground passing through the gun. To determine the vertical projection of the burst in the plane of fire, it is now necessary to consider the plane of the paper as representing this plane of fire. The target position *T* remains as before. The line *S'T*, originally representing the horizontal projection of the Gun-Target line, should now be considered as representing a horizontal line through the target and contained in the vertical plane of fire. If, now, the mean angular height as obtained by averaging the records kept at the battery be laid off from this horizontal line, the result will be the Gun-Target line or line of position in the plane of fire.

(6) A construction line was drawn parallel to this line of position *B*-1 in the proper sense and at a distance proportional to the vertical deviation in yards. Thus, this line was the vertical projection, in the plane of fire, of the line of sight from the battery observing station to the burst, and the vertical projection of the burst must fall somewhere on this line.

(7) Having the horizontal projection of the position of the burst and a line in the vertical plane on which it must fall, it only remains to transfer the horizontal projection *C* to this line, and the resulting point will be the projection of the burst in the vertical plane through the line of fire. As the vertical plane is the horizontal plane revolved about *S'T*, the target remaining fixed, a line perpendicular to *S'T* through the horizontal projection of the burst *C* will intersect the vertical projected line of sight through the burst *B*-1 at a point *D*, which will thus be the projection of the burst in the vertical plane of fire.

b. By use of xylonite plotter and straight edge. (1) A xylonite plotter (Figure 7), submitted for test, was used to convert deviations to yards automatically, when set at the proper slant range. This was used for plotting to some extent and found to be much faster than the method of scaling deviations and drawing construction lines parallel to projected lines of sight.

(2) In this method the three basic line, *S'T*, *S''T*, and the line of position were laid out as previously described. The side edge 3 (Figure 7) of the plotter was placed parallel to *S'T*, with the target *T* (Figure 6) at the number 1 (Figure 7) equal to the slant range from battery to target. A straight edge was placed along the bottom edge of the plotter as shown in figure 8. This enabled the operator to move the plotter along this straight edge to set off any deviation, keeping the side edges always parallel to the line *S'T* and the slant range set.

(3) To draw the horizontal projection of the line of sight through the burst it was only necessary to slide the plotter along the straight edge until the proper deviation line 2 (Figure 7) came directly over the target *T* (Figure 6). The sense of the deviation determines which side of the plotter to use. As this plotter was drawn to the scale to be used in plotting, as described hereinafter, and the edges have remained parallel to *S'T*, the edge on the side of the plotter

which was used was the horizontal projection of the line of sight through the burst from the battery position. A light construction line was drawn along this edge, which gives the same line *L*-3 (Figure 6) as previously described in paragraph (*a*) 3.

(4) Similarly, the plotter is set parallel to $S''T$ and at the slant range from the flank station to the target. The deviation of the burst as observed from the flank station was set as described above and that part of the construction line *S*-8 (Figure 6) drawn that intersects the lateral deviation line. This intersection *C* (Figure 6) was the horizontal projection of the burst as described in paragraph (*a*) 4.

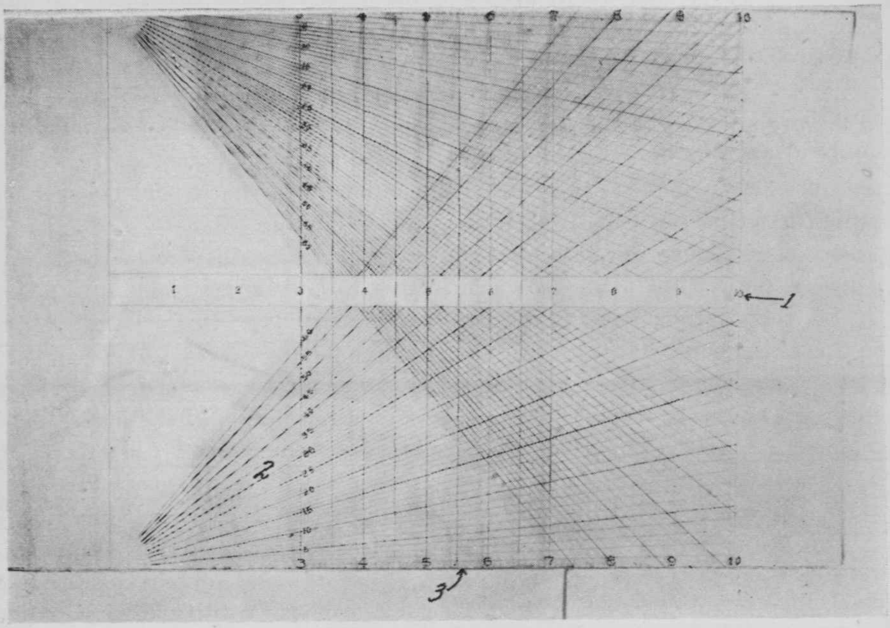


FIG. 7. XYLONITE PLOTTER

(5) Similarly, the vertical projection of the line of sight through the burst was drawn parallel to the line of position, and the point *C* (Figure 6) projected to this line, giving the vertical projection of the burst along the line of fire.

(6) The main advantage of using this plotter is that instead of plotting one burst at a time, ten or more can be plotted with each set up in very little more time than one burst. But care must be taken in properly marking the construction lines so that they can be identified.

c. By use of xylonite plotter and Universal Drafting Machine. (1) The xylonite plotter mentioned before was fitted, with an attachment which allowed it to be used on a drafting machine so that any edge could be placed parallel to any of the basic lines and clamped. Thus, in any position on the drawing board it would always be parallel to the line by which it was first set.

(2) To speed up further this work of plotting it was found that when the plotter was once set with the slant range over the target, a pin could be placed against its top edge so that by keeping it against this pin and sliding it along to the proper mil deviation line, the slant range remained set.

(3) To begin a plot of bursts, the same basic lines are laid out as in the first case. The plotter is first set with side parallel to $S'T$, clamped in that position, slant range set, and pin placed in board at top edge of plotter. Now the plotter is moved right or left as the sense of the deviations indicates, and to the proper mil deviation lines and light construction lines drawn along its side edge and numbered for each shot observed by the lateral observer on this course or part of course.

(4) Next, the drafting machine head is unclamped and the edge of the plotter moved and clamped parallel $S''T$. The new slant range is set as before and the flank station deviation construction lines are drawn to intersect the lateral deviation construction lines and these intersections numbered according to their shot numbers. These are the horizontal positions of the bursts.

(5) Again the drafting machine head is unclamped, moved so the plotter's side edge is parallel to the line of position, and clamped. The slant range from battery to target is set again as in the case of the lateral, and the vertical deviation construction lines are drawn and numbered.

(6) Then, resetting the plotter to the first position, with side edge parallel to $S'T$, use the top edge which is at right angles to the side edge to drop the perpendiculars from the horizontal projections of the bursts C (Figure 6) to the vertical construction lines. These last intersections are then the positions of the bursts in the vertical plane through the line of position.

6. *a.* In order to calculate the center of impact of the group of shots as plotted, the rights and lefts as well as aboves and belows are figured directly in yards from the mil deviations and slant range, and the bursts are then measured for overs and shorts. This measurement is along the line of position to a line or plane perpendicular to the line of position at the center of the towed target or, as shown on the vertical plot (Figure 6) along the vertical deviation construction line to the forward edge of the danger volume. This method of measuring overs and shorts differs from that used in previous years, as before they were measured along the horizontal to a vertical plane through the target. It is believed to be much better to measure them along the line of position, as that is a close approximation to the actual over or short on the trajectory line.

b. The next step, after making the vertical plot as described, is to determine the number of bursts that landed in the danger volume. This was done by superimposing a target F (Figure 6) drawn on xylonite to scale over the vertical plot with its center line along the line of position and its axis at the target T.

c. If any vertical projection of bursts such as D (Figure 6) is within this danger space, it then must be projected to a plane through the target perpendicular to the line of position. The danger space is first projected to this plane

in the manner shown in Figure 6, *G* being the projection of the plinth and *H* the column. The burst in question is then projected by a continuation of the vertical deviation construction line and the lateral deviation in yards is measured off from the vertical line through the projected danger space, shown in Figure 6 as perpendicular to the line of position. This gives the position as shown at *E*, which is the position of the burst as seen from the battery. Therefore, to be a hit this burst, if it landed in the plinth, must be in the plinth projected or if in the column, it must land in the projection of the column. In the example (Figure 6), the burst was not a hit although it was in the column as for range and vertical, but was not in the column projection for lateral deflection.

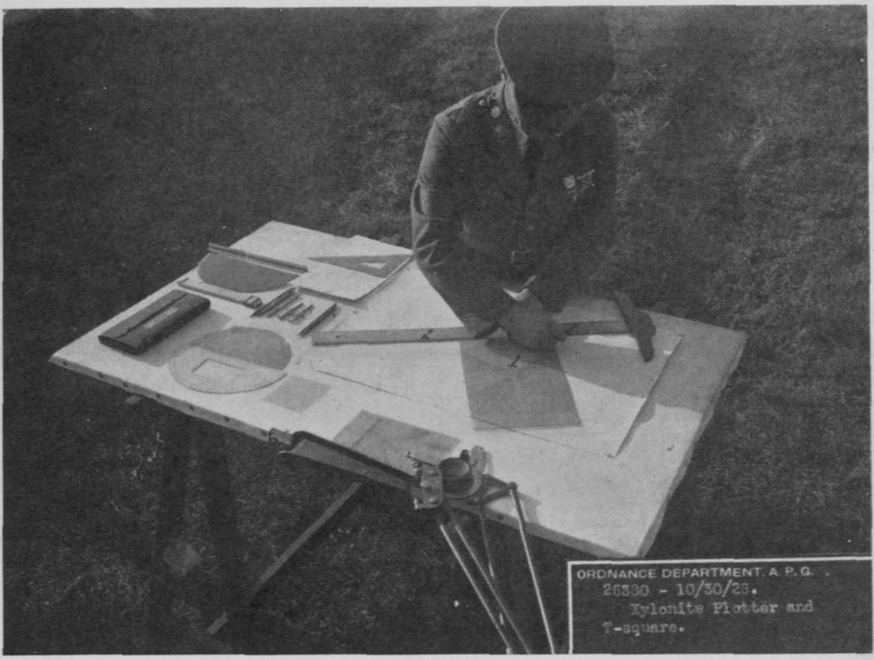


Fig. 8

d. In any case where a burst landed close to the edge of the superimposed danger space and had a chance of being a hit for deflection, it was replotted to a scale of 1 inch equals 10 yards. This practically assures a correct plot.

7. Another method of observing and plotting was submitted by the 64th Coast Artillery, but was received too late to be used, as it required the construction of a special flank observing instrument. This instrument is so designed that it observes the longitudinal deviations along the line of position. The bursts could then be plotted directly in the slant plane containing the line of position, using the impact charts made up for target angles for every ten or twenty mils. These could be constructed before the firings.

III. Spotting Instrument, Model 1920, A. A. Telescope

1. *Introduction.* *a.* With the adoption of a base-line system of spotting for antiaircraft artillery and no instrument issued for this purpose, it became necessary to improvise some instrument which could be used for observing lateral and vertical deviations from the battery position and rights and lefts from a flank position.

b. It was soon apparent that an observer cannot follow the target and at the same time observe the deviations of the bursts and it was therefore necessary to have this instrument trained by a separate observer. It was found also that one observer could not observe both the lateral and the vertical deviations with bursts occuring at a rate of one per second or greater. Therefore it was necessary that the instrument at the battery position have two observing instruments as well as a trainer's instrument. At the flank station the two observing instruments are not so necessary, as one observer can observe both rights and lefts. However, it has been found that it is best to have two observers at this instrument as well, one to observe lefts and lines, and the other rights, as the deviations are usually large as seen from the flank station, being, for all practical purposes, range deviations. It is quite difficult for one observer to watch both sides of his observing glass, especially when some bursts appear out near the edge of the field.

c. Again, from a study of the base-line system as described in Section I, above, it can be seen that it is necessary to make a horizontal plot of the course of the target, and to do this the instrument must be capable of being accurately oriented and the azimuth of the target read at any desired time. It is also desirable to be able to read angular heights from the battery instrument.

d. Another consideration is the lighting of the graduations for night observing, as the reflected light from the searchlights is not sufficient for this purpose. For training, however, this light is sufficient to illuminate the cross-hairs.

e. Such an instrument has been improvised and used in the antiaircraft exercises at Aberdeen Proving Ground in 1927 and 1928 and at other target practices.

2. *Description.* *a.* The main body of the instrument consists of the complete A. A. Telescope, Wind and Parallax Computer, model 1920. This instrument meets the requirements of portability, training, and orientation.

b. The instrument (Figure 1) consists of a tripod, base plate with azimuth scale (2), telescope mount, elevating arc and screw (4) and telescope (1).

(1) The tripod is of the standard three-leg, adjustable and folding type.

(2) The base plate is made to clamp to the tripod when oriented, allowing the arms (2) and (3) to move with the telescope. One of these arms is used for traversing either by hand or with the slow-motion device as shown in figure 9. One of the shorter arms (3), with a piece of tin attached, is used for marking a line on the plate to designate a certain azimuth. As used in spotting, the azimuths of the target at the instants of first and last bursts are

marked. One of the other arms has a pointer (2) attached to it to read azimuths from the base plate. The outer rim of the base plate is graduated to ten mils.

(3) The standard used for supporting the telescope is attached to the arms previously described. The telescope is attached to this standard by trunnions and an elevating hand screw mounted on these trunnions works through a worm screw to the elevating rack on the under side of the telescope.

(4) The angular-height pointer is also attached to the trunnions and the scale to the telescope. The pointer is adjustable.

(5) The telescope is a two-power instrument having both 10 and 25-power magnification through two different eyepieces, either of which can be brought into use by a lever on the rear of the telescope.

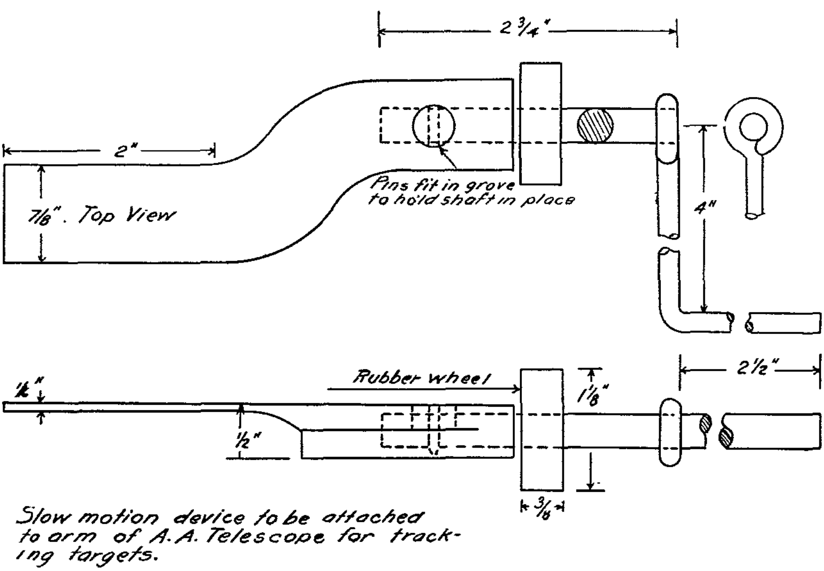


FIG. 9

c. The added equipment consists of cross-bar, with clamp with which to fasten it to the telescope, and a model 1917 gun sight mounted at each end of this bar.

(1) The cross-bar is made of U-section iron or steel, tapered at the ends and having holes bored in the web to lighten it. The center is cut away to fit the telescope and the clamp, consisting of a U-shaped rod with threaded ends, is brought through holes in the top where washers and nuts are screwed on, thus clamping the bar tightly to the telescope.

(2) At each end of the bar is attached a device which may be either of the design as shown in Figure 1 or as shown in Figure 2. In Figure 1 the method used is by means of set screws clamping metal blocks to pins, one pin attached to the gun sight by a band clamp, and running through a hole drilled in the outer block (8). By loosening the set screw in this block the sight can

be moved in the horizontal plane. This outside block is connected to the end of the cross-bar by the same arrangement, so that loosening the inside block's set screw allows the sight to be moved in the vertical plane. These two motions allow the observers to colliminate the two gun sights with the main telescope. The other system of attaching sights is plainly shown in Figure 2 and is believed to be easier made and more satisfactory.

(3) Each sight has graduated cross-hairs on which the least graduation is 5 mils. For the battery observing instrument, the reticules in one of the sights must be turned through 90° so the graduation will read vertical deviations.

(4) The lighting device consisted of two small flashlight cells strapped to the underside of the cross-bar (Figure 1) and connected through a switch (6) to a small flash-light bulb (9) mounted above the gun sight. This bulb is dimmed by painting with black paint but gives sufficient light to illuminate the cross hairs. The target cannot be seen when the light is on but the flash of the bursts are plainly visible.

IV. Synchronizer

1. *Introductory.* *a.* For a visual system of spotting it is necessary that some means be provided for recording the deviations as called by the spotters and synchronizing them so that there is assurance that the three deviations of one burst are the ones observed of that burst.

b. To do this, a special synchronizer was manufactured by Frankford Arsenal and used at the flank station for recording all visual observations for these exercises. The general layout is shown in Figure 10.

2. *Description.* *a.* The instrument (Figure 3) consists of a wooden box about 43″x 13″x 6″ open at the bottom and having two 41-inch slots in the top to allow the paper to pass over the recording space on the top.

b. The rollers are of wood, 3 inches in diameter and about 41 inches long, mounted to the ends of the box with brass bearings. A steel rod runs through each roller to act as a shaft and fits in these brass bearings. Each roller shaft is connected through the ends of the box to a turning handle to allow the rollers to be turned. The forward rolling is done by a small crank (1) which is geared to the upper roller shaft. This reduction gearing allows the roller to be turned slowly and smoothly. The lower roller is also connected to a turning knob (6) on the outside for reversing the motion of the rollers and to wind the paper back on the lower roller.

c. It was found that ordinary paper did not prove satisfactory, as the strain of rolling from one roller to the other caused it to tear and the erasing of figures recorded on it quickly ruined the writing surface, so standard 40-inch tracing cloth was used. Also, it was found necessary to tack a piece of tracing cloth to the top of the box over which the roll of cloth moved, in order to give a better writing surface and to reduce friction. About twenty feet of this cloth were provided and it was found that very rarely was over half of it used, although as many as 120 sets of deviations were recorded. This cloth was attached

to the rollers with thumb tacks and aligned as perfectly as possible to prevent rolling unevenly or toward one edge. Three lines (2, 3, and 4) were drawn down this paper so that the sense of the deviation was recorded by the side of this line on which a given deviation was recorded.

d. This cloth was fastened to one roller, brought through the slot above that roller to the top of the box, across the top about four inches, and down through the second slot to the other roller. In rolling from one roller to the next, about four inches of this cloth moved along the top of the box in such a manner that deviations could be recorded on it with soft pencils as it moved. It might have been better to have had a window for each recorder but it was

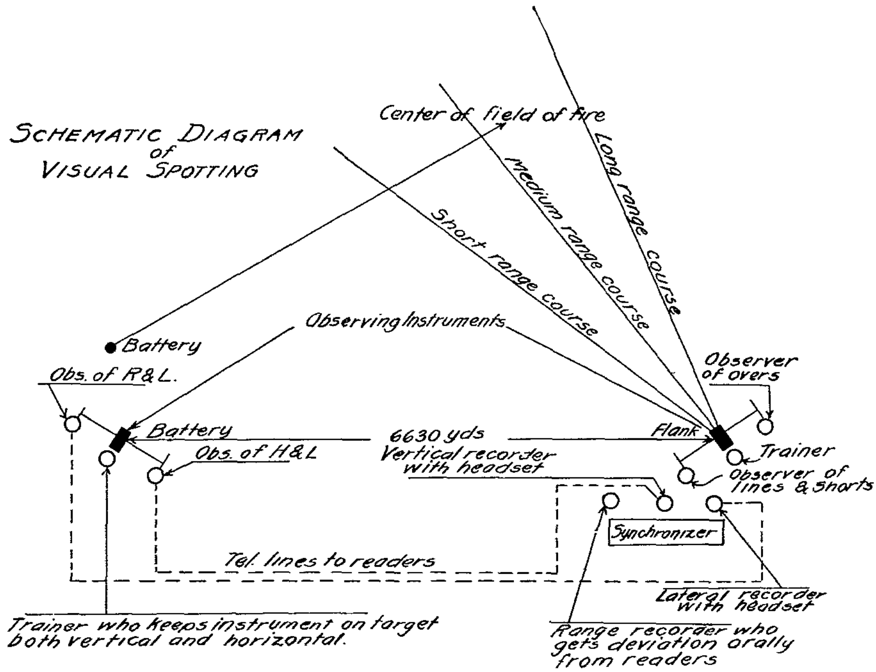


FIG. 10

thought better to place a brass strip (5) along the edge of the recording space and to require the recorders to write as near this brass strip as possible. If the deviations were called at the instant of burst all recorders would receive them and record them at the same instant. Writing close to the brass strip would then assure that the deviations were synchronized.

e. To operate the synchronizer, three recorders are needed: lateral, vertical, and longitudinal. During the exercises, the synchronizer was placed at the flank station and two telephone lines run from the battery observing instrument to the lateral and vertical recorders, who wore headsets. The logitudinal recorder received his deviations orally from the observers at the flank. When the first shot was fired, the flank station was notified and the operator of the synchronizer started turning the crank, causing the recording cloth to move over

the top of the box. As the deviations were received by the recorders they were written on either side of the lines 2, 3, and 4. Any other items of interest later, such as "lost," "over," "target in clouds," etc., was written on the cloth. Also, the course number was recorded.

f. After the practice the cloth was rolled backwards to the beginning and the deviations read off and recorded on the data sheets. Then the figures written on the cloth were erased and the synchronizer was ready for the next practice.

V. Stephens' Xylonite Plotter

1. *Introduction.* *a.* A plotter (Figure 7) was designed, constructed, and submitted by Master Sergeant Stephens, of the Coast Artillery, for test in plotting the position of bursts for antiaircraft firing.

b. This plotter, which is based on proportional parts, is designed to convert mils of deviation at any given slant range, to yards at the scale used for plotting.

c. It was originally designed to use with a straight edge but was found to operate more satisfactorily and faster attached to a Universal Drafting Machine. However, it was used somewhat with only a straight edge and proved very efficient.

2. *Description.* *a.* The plotter was made of xylonite in the form of a rectangle. Edges were made perfectly smooth and at right angles to each other.

b. Any convenient scale could be used for laying off slant ranges the longer way of the plotter. The model used had a scale of 1 inch equal 2000 yards. It is believed that a more convenient scale is 1 inch equals 1000 yards. Thousand-yard lines are drawn across the plotter, and graduations in the center to every 100 yards is convenient. The thousand-yard lines should be numbered.

c. The scale across the plotter must be that decided on for the scale of plotting. One inch equals 50 yards was used for these exercises and this plotter was made to that scale. To lay off the mil deviation lines (2) each mil value in yards at 10,000 yards was laid off from each side edge along the 10,000-yard slant range line and these points connected to the zero slant range line at each edge of the plotter. The 5-mil lines were made heavier to make them stand out. These lines therefore crossed each slant range line at a distance, to the scale of the plotter, of the amount of that deviation in yards at that slant range. Each 5-mil deviation line was numbered at two points to make it easier to pick out.

d. An attachment, taken from the end of a ruler used on the universal drafting machine, was fastened to the end of the plotter so it could be attached rigidly to the head of the drafting machine.

The Battles Around Chattanooga

I. The General Situation

By Major Edward B. Dennis, C. A. C.

General Situation

AFTER about two and one-half years of war, the Northern armies held the general line: South bank of the Potomac River—Allegheny Mountains—Tennessee River to a point just south of the Alabama state line, thence west and south to New Orleans. The country north of this line and east of the Mississippi was definitely under Northern control. The Southern ports were either in possession of Northern troops or blockaded. The main armies of both sides were engaged in Northern Virginia or in Eastern Tennessee.

From January to June, 1863, Northern troops, numbering some 60,000 (at the end of that period) held Murfreesboro, Tennessee, under Major General Rosecrans.

During the same time, Southern troops, approximately 43,000 in all, covered the routes to Chattanooga, under Lieutenant General Bragg.

Northern cavalry was outnumbered by Southern cavalry, which was more active.

On June 23, 1863, the Northern general issued orders for a forward movement toward Chattanooga.

In nine days, during the period June 24-July 3, the Northern troops, without a serious engagement, had so maneuvered as to force the weaker Southern forces to abandon an entrenched camp at Tullahoma and all of Tennessee west of the Tennessee River.

The Southern troops retired to Chattanooga.

On July 4, 1863, on another front, victorious Northern troops were released by the fall of Vicksburg and became available for reinforcements elsewhere.

Chattanooga, which is located on the south bank of the Tennessee River, was vitally important to both sides. The possession of the routes passing through Chattanooga to Knoxville and southward from Chattanooga to Dalton, Georgia, was essential to any advance of the Northern forces to the south and in like manner equally essential to any offensive operation by Southern troops against the north.

On July 25 trains were running to Bridgeport, Alabama, and that town subsequently became the railhead for Northern troops.

Lack of supplies and insufficient communications somewhat retarded the advance of the Northern troops, who camped in the general line Winchester-McMinnville.

On August 16 the Northern troops again began their advance with the object of crossing the Tennessee River below Chattanooga, turning the left of

the Southern forces, intercepting their communications, and capturing Chattanooga from the rear.

By September 4 the Northern troops had crossed the Tennessee River in several places.

On September 8 the Southern army, whose effective strength at this time was estimated as being 20,000, evacuated Chattanooga without any defensive action against the superior Northern forces and concentrated along the east bank of the Chickamauga Creek from Lee and Gordon's Mill to Lafayette.

The Northern general believed the enemy was retreating towards Rome, Georgia.

On September 9 a brigade of Northern troops under General Crittenden took peaceful possession of Chattanooga while the main body advanced up the East Chickamauga Creek and railroad to Ringgold and Dalton.

Meanwhile the Southern forces were concentrating around Lafayette (twenty-five miles southeast of Chattanooga). Reinforcements poured in, including a heavy corps from Lee's army. In a short time Lieutenant General Bragg commanded an army of 92,000 men.

Skirmishing occurred on the 11th, 12th and 13th, and it became evident to the Northern troops that the forces opposed to them were stronger.

On September 17 the Northern troops were attacked in strength and gave ground.

As late as September 18 neither army knew the exact location of the other.

During September 19 and 20 the battle of Chickamauga was fought. On Sunday, September 20, the opening of the battle was delayed until 8:30 A. M. on account of a dense fog. By 4:00 P. M. of the twentieth the Southern forces had gained a decided advantage and the Northern troops started to retire towards Rossville. There was no pursuit.

On September 21 the Northern troops withdrew at night, in good order, to positions in front of Chattanooga. The Southern forces, although victorious on the battlefield, failed to reap the full benefits which an active pursuit would have given them.

The forces engaged on September 19 and 20 were approximately as follows:

Northern: 55,000 to 56,000, all arms (including 10,000 cavalry).

Southern: 61,000 to 71,000, all arms (including 14,000 cavalry).

Losses were estimated as—

Northern: 16,000 men.

Southern: 18,000 men.

The Northern troops were beaten and driven back to Chattanooga and there besieged by the very army they had successfully maneuvered out of that town.

On September 23, 1863, the Northern troops in Chattanooga, whose effective strength was estimated as about 35,000 men, were opposed to Southern forces numbering about 55,000 men.

The cavalry of both sides was located well to the flanks along the Tennessee River.

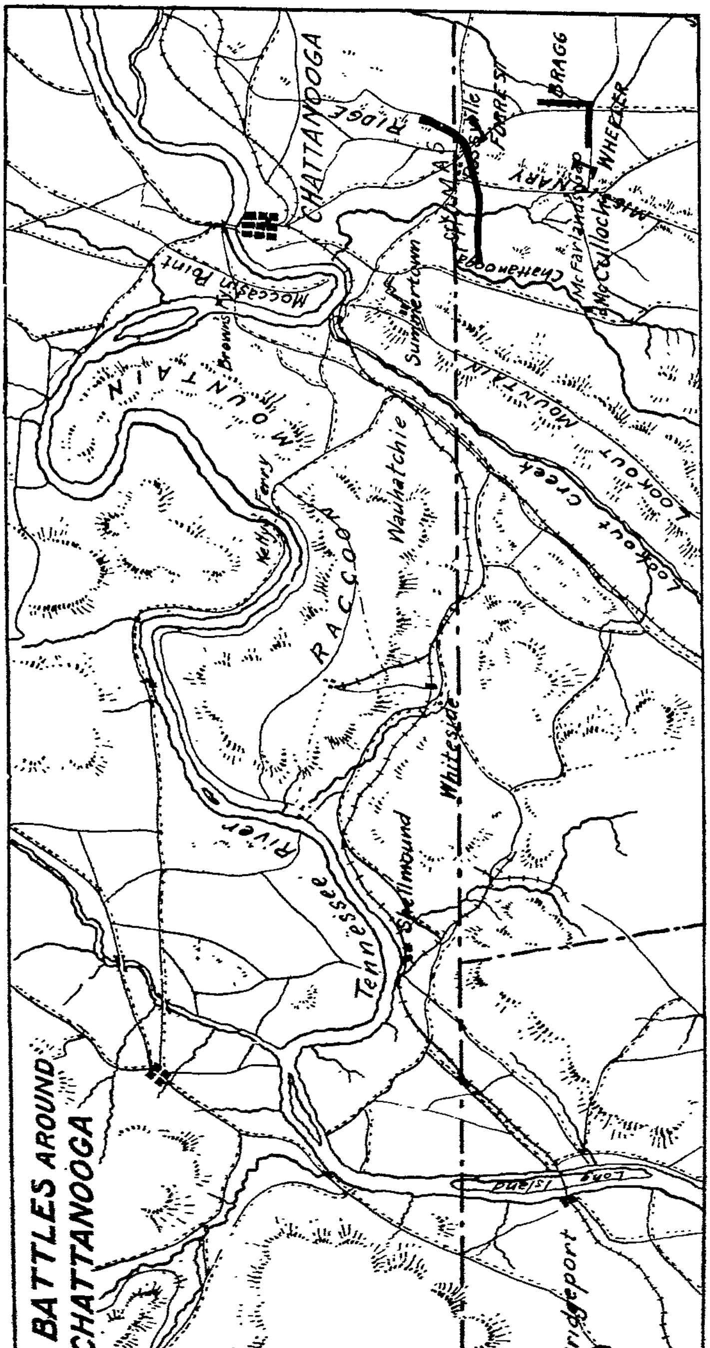

BATTLES AROUND CHATTANOOGA
CHATTANOOGA
RIDGE
BRAGG
FORREST
WHEELER
Chattanooga
McFarlands
McCullochs
Moccasin Point
Browns
MOUNTAIN
RACCOON
Kellys Ferry
Wauhatchie
Summertown
Lookout Creek
Lookout Mountain
Whiteside
Shellmound
Tennessee River
Long Island
Bridgeport

FIG. 1

Special Situation (North)

In their retreat to Chattanooga, the Northern troops made no effort to hold Lookout Mountain, the railroad, or the river below Chattanooga.

The length and condition of the roads made wagon transportation from Bridgeport a precarious means of supply for the beleaguered Northern army. The situation was critical for the Northern forces.

Northern cavalry, holding the north bank of the Tennessee River from Caperton's Ferry to Washington, protected the flanks of the forces in Chattanooga and their line of communications. Crook's division kept watch for fifty miles up the river and McCook's men stood guard at the crossings above and below Bridgeport. Only the main fords could be watched.

Southern cavalry continued superior in strength to Northern cavalry.

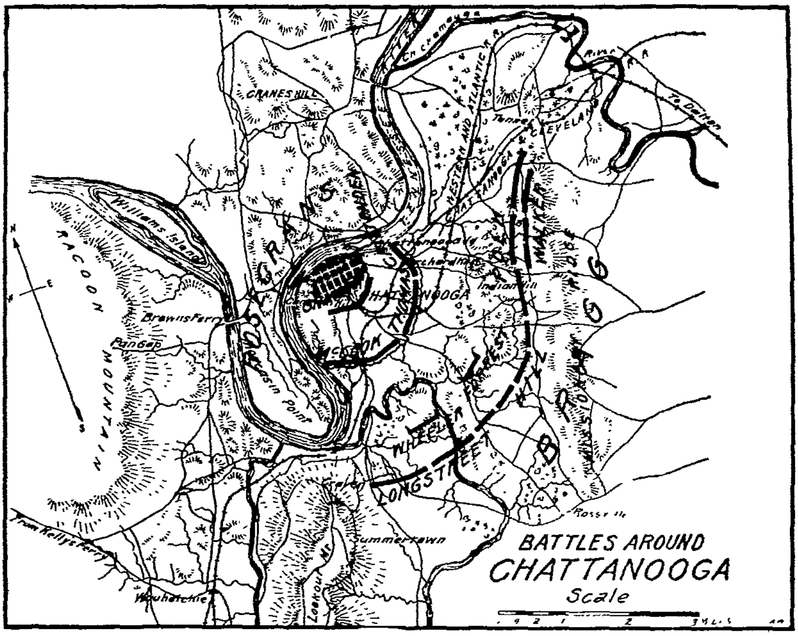


Fig. 2

The Battles Around Chattanooga

After withdrawing from Rossville Gap on the night of September 21, 1863, the Northern forces (Army of the Cumberland) formed in front of Chattanooga from the river above the town to the bend in the river below.[1]

Of the Northern army some 35,000 men now occupied as salients the strong unfinished works left by the Southern troops and before noon of the twenty-second had them connected by rifle pits.[2] The Southern forces followed their

[1] 50 Rebellion Records 196.
[2] 50 RR 197, 706; 53 RR 696, 706.

enemy northward on the twenty-second and twenty-third and occupied positions in front of the Northern army.

The line held by the Southern troops extended along the western base of Missionary Ridge from the railway tunnel to a point about two miles farther south than Orchard Knob, thence westerly across Chattanooga Valley to Lookout Mountain.[4] The commander of the Southern troops, Lieutenant General Bragg, contented himself with investing the Northern army with the foregoing incomplete line.[5]

To the Southern cavalry, under command of Major General Joseph Wheeler, was given the task of cutting the communications of the Northern army with its depot in Bridgeport on the northern side of the river and the destruction of the railway beyond that point.[6] The Northern cavalry held the northern bank of the Tennessee River from Washington to Caperton's Ferry (near Stevenson) to protect the trains passing from Bridgeport to Chattanooga.[7]

On September 30 General Wheeler, with some 4500 of his Southern cavalry and 12 guns, crossed the river near Washington and made for the Northern line of communications.[8] As soon as the fact became known, General Rosecrans gave orders to General Crook to pursue and to Colonel McCook to march from Bridgeport to Anderson's Crossroads.[9]

On October 2 Wheeler, moving via Pikeville, intercepted and partially destroyed a train of ammunition and supply wagons near Anderson's Crossroads.[10]

Colonel McCook, upon the receipt of his orders, gave instructions to his second brigade to join him at Jasper.[11] He then started with the First Wisconsin, the Second and Fourth Indiana Regiments, and a section of artillery.[12] Rain delayed the marching.[13]

On October 2 McCook, as he approached Anderson's, saw smoke and, later burning wagons.[14] He advanced, encountered a portion of Wheeler's troopers, and then charged with the First Wisconsin and Second Indiana Regiments and drove the enemy past the burning wagons and upon the main body, which was one mile north of the crossroads, in line of battle. These two regiments dislodged the enemy from successive positions and pursued for two miles driving the enemy across the Sequatchie Valley.[15] In this action the saber was freely used.[16]

On October 3 the pursuit was continued to the top of the mountain beyond Dunlap, where the rear guard was again attacked with successful result.[17]

Altogether, McCook captured twelve commissioned officers and ninety-three enlisted men, and killed seven officers and several enlisted men.[18] Three hundred mules were recaptured and some of the wagons were saved.[19] The enemy

[3] 53 RR 681, 689, 692.
[4] 53 RR 697.
[5] 53 RR 706.
[6] 51 RR 664; 53 RR 695, 711.
[7] 51 RR 664, 669.
[8] 50 RR 205; 51 RR 664; 52 RR 953, 956; 53 RR 26, 109, 134, 734.
[9] 50 RR 205; 51 RR 664; 52 RR 32; 53 RR 21.
[10] 53 RR 31, 38.
[11] 51 RR 675, 682.
[12] 51 RR 675, 689.
[13] 51 RR 675; 53 RR 9.
[14] 51 RR 675, 683.
[15] 51 RR 675; 53 RR 61, 68, 69, 85.
[16] 51 RR 697; 53 RR 69.
[17] 51 RR 696; 53 RR 70.
[18] 51 RR 675, 696.
[19] 51 RR 675, 697.

destroyed three hundred wagons and a large number of mules.[20]

The force had previously divided, Wharton's division having been sent to McMinnville by a detour to the north.[21] In the meantime General Crook's command had ascended the mountain south of Smith's Crossroads and was in rapid pursuit toward McMinnville.[22] On October 3 he overtook Wharton's rear guard descending the Cumberland Mountains. It was late in the day and they escaped.[23] On the fourth the pursuit was resumed but Wharton's men captured McMinnville and the stores at that station before Crook's arrival. A large amount of property was destroyed by the Southern raiders. The Southern troops marched rapidly on Murfreesboro.[24]

Colonel Crook again encountered the rear guard on the Murfreesboro road. The Second Kentucky charged, pursuing through the Southern lines for about five miles, which compelled the main column to turn and fight. Darkness stopped the fighting.[25]

Squads were sent out by the Southern troops to cut the telegraph wires between Murfreesboro and Nashville.[26] Murfreesboro was saved from pillage by the arrival of the Northern troops.[27]

On October 6 General Mitchell, the senior cavalry commander, arrived at Murfreesboro and on the following night the whole command bivouacked seven miles from Shelbyville.[28] On the seventh it was learned that Wheeler had divided his command into three columns, directed respectively to Wartrace, Shelbyville, and Unionville.[29]

General Mitchell sent McCook to Unionville and Crook to Farmington.[30] The infantry drove the Southern cavalry under Davidson to Farmington. Colonel Miller led a charge through the Southern lines and broke through, capturing some artillery.[31]

On the eighth the Northern troops followed the Southern cavalry, marching on Pulaski.[32] On the ninth they passed through Pulaski to Rogerville, where they learned that the Southern troops had succeeded in getting across the river with a loss of seventy men belonging to their rear guard.[33] On the tenth information was received that a second force of 2000 Southern cavalry under General Roddey, with four pieces of artillery, having failed to make a junction with Wheeler, was marching for the fords of the Tennessee River.[34]

Roddey, learning that Wheeler had been severely repulsed at Farmington and was retreating, counter-marched, starting back at daylight the eleventh or twelfth for Athens, Alabama.[35]

General Lee, with a third body of Southern cavalry, who had been ordered to cross the Tennessee River and cooperate with Wheeler and Roddey, deemed it too hazardous under the circumstances and remained south of the river.[36]

[20] 53 RR 37, 38.
[21] 50 RR 206; 53 RR 43, 49, 60, 156.
[22] 51 RR 677; 53 RR 61.
[23] 51 RR 664, 676.
[24] 50 RR 107; 53 RR 78, 79, 84, 85, 174, 217.
[25] 51 RR 686.
[26] 53 RR 79.
[27] 53 RR 135, 160, 217.
[28] 51 RR 667, 669, 679.
[29] 51 RR 669.
[30] 51 RR 670.
[31] 51 RR 607, 666, 670; 53 RR 370, 757.
[32] 51 RR 670, 677.
[33] 51 RR 670, 677, 680.
[34] 51 RR 671, 680, 729.
[35] 51 RR 665, 678, 729.
[36] 51 RR 665; 53 RR 21.

Meanwhile the condition of the beleagued army became serious. The destruction of hundreds of wagons and animals by Wheeler was almost fatal to the Northern army. Each trip to Bridgeport was made with fewer wagons and lighter loads. This resulted in a like reduction in the rations issued.[37] Early in October rains set in and soon the roads became almost impassable.[38]

By examining the map it will be seen that the Tennessee River flows west for a mile or two at Chattanooga, then bends and flows south for about two miles until it strikes the rock of Lookout Mountain, by which it is turned around to the west again. Then it flows north and makes a deep bend around the northern end of Raccoon Mountain. With two or three more windings around the mountain spurs it passes Bridgeport. Across the narrow tongue of land called Moccassin Point was Brown's Ferry, which was located about two miles from Chattanooga and at the eastern end of the route that led over Raccoon Mountain to Kelly's Ferry. By this route Kelly's Ferry was only eight miles from Chattanooga; by the river it was twenty-odd miles.

A plan was devised by General W. F. Smith, Chief Engineer of the Northern army, to throw a pontoon bridge across the Tennessee at Brown's Ferry, get control of the country south of the river and west of Lookout Mountain, and establish a line of communication by wagon road from Chattanooga to Kelly's Ferry and by boat from the ferry to Bridgeport.[39]

On October 16 an order was issued which relieved General Rosecrans from the command of the Northern forces at Chattanooga and placed General Thomas in his place. This order also combined the departments of the Ohio, the Cumberland, and the Tennessee under the sole command of General Grant.[40]

II. Shortening the Line of Communications

By Major Edgar B. Colladay, C. A. C.

Pursuant to G. O. 337, W. D., October 16, 1863, delivered to General Grant at Louisville, Kentucky, by the Secretary of War on October 18, General Grant assumed command of all forces in the western theater of operations and General Thomas replaced General Rosecrans at Chattanooga.[41]

During the following week there was little or no fighting in the vicinity of Chattanooga. Light artillery fire from Confederate batteries did little harm. On October 23, 1863, General Thomas ordered General Hooker to concentrate part of his forces, the XI Corps and the 1st Division of the XII Corps, at Bridgeport preparatory to moving on Chattanooga.[42]

General Grant, on his arrival in Chattanooga on October 23, approved a plan (which had been devised by the beleaguered troops) for shortening the communications of the Federal troops. This plan was as follows: General Hooker, leaving sufficient guard for the railroad to Nashville, was to move from Bridgeport by way of Whiteside's to Wauhatchie. General Palmer was

[37] 50 RR 214, 216, 218, 220; 53 RR 14, 36, 65.
[38] 53 RR 9.
[39] 50 RR 216.
[40] 53 RR 478, 485.
[41] 55 RR 11, 27.
[42] 54 RR 42.

to cross the river near Whiteside's to protect General Hooker's line of communications. A force under General William P. Smith, Chief Engineer of the Army of the Cumberland, was to cross at Brown's Ferry to seize the hills covering the Brown's Ferry road and thus secure the wagon route to Kelly's Ferry. At this point supplies could be delivered by boat from Bridgeport. General Smith had prepared about fifty pontoons and two large flat boats to be used in transporting troops from Chattanooga to Brown's Ferry by the river for the initial crossing.[43]

The south side of the river from Lookout Mountain to a point five miles down the river was picketted with two regiments of General Law's brigade to prevent the passage of Federal wagon trains along the road on the north side of the river. The rest of General Law's brigade was in support.[44]

At 3:00 A. M., October 27, 1863, a few hours before General Hooker marched from Bridgeport, about 1500 men under General Hazen embarked in the pontoons and flat boats provided by General Smith. They floated down the river close to the north shore. Due to darkness and fog they were not discovered by the Confederate pickets until they were about to land on the opposite shore at Brown's Ferry. The Confederate pickets opened fire. The Federals returned the fire and the Confederate pickets withdrew. A landing was effected and the crest of a line of hills about 500 yards from the river secured before the Confederates could organize any resistance. The Confederates shortly attacked and forced the first landing wave part way back to the river. The second wave under Col. Langden had landed by this time and reinforced the Federal line.[45]

The Confederates were now forced back and they withdrew to the left. General Law's supporting troops took up a defensive position across the valley covering the withdrawal of all Confederate river pickets. General Law then withdrew his entire force toward Lookout Creek, to the west of which he took up a defensive position.[46]

In the meantime the rest of General Smith's command, which had marched from Chattanooga across Moccasin Point, were ferried across the river at Brown's Ferry. In less than one hour 5000 men and two pieces of artillery had crossed. During part of this movement the Confederates placed an ineffective artillery fire on the Federal troops. The pontoon bridge was placed in position and completed before noon the same day. The Federals then took up a defensive position covering the bridgehead.[47]

General Hooker, pursuant to orders from the Department, marched early October 27 via Whitesides to Wauhatchie, with General Howard's Corps in the advance and General Geary's division in the rear. The command gained contact with General Law's troops in the vicinity of Wauhatchie in the afternoon of October 28 and drove them back. General Law then withdrew across Lookout Creek. General Hooker's Headquarters and General Howard's Corps went into camp one mile south of Brown's Ferry and General Geary's Division camped in the vicinity of Wauhatchie.[48]

[43] 54 RR 78, 224; 55 RR 27.
[44] 54 RR 216, 224.
[45] 54 RR 78, 82-84, 86-87.
[46] 54 RR 88-89, 224-226.
[47] 54 RR 78, 224-226; 55 RR 28.
[48] 54 RR 48, 92, 101, 102, 224, 225.

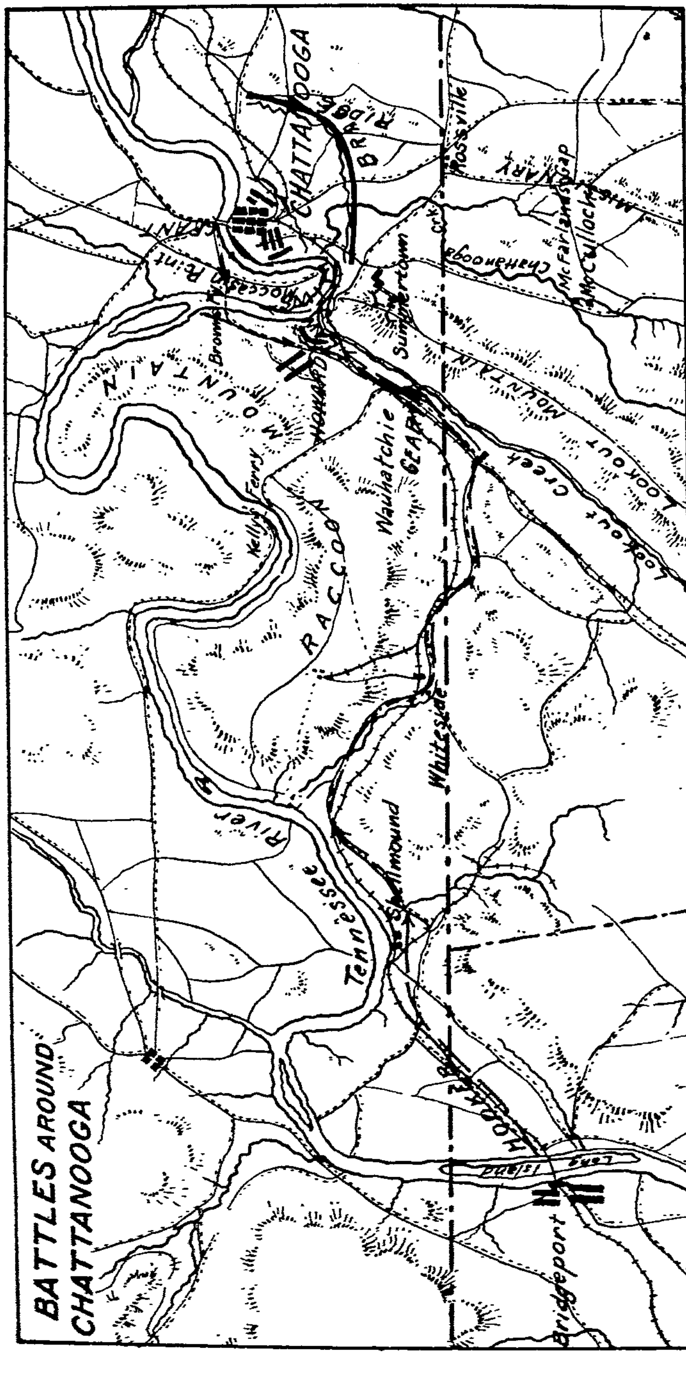

BATTLES AROUND CHATTANOOGA
CHATTANOOGA
BRAGG
Rossville
Moccasin Point
Browns Ferry
HOWARD
Summertown
Chattanooga Crk
McFarlands Gap
McCulloch
Lookout Mountain
Lookout Creek
GEARY
Wauhatchie
Kellys Ferry
RACCOON MOUNTAIN
Whiteside
Shellmound
Tennessee River
HOOKER
Long Island
Bridgeport

Fig. 3

During the latter part of the march and after General Law's command had withdrawn, the Confederate batteries on Lookout Mountain fired on General Hooker's column but with little or no effect.[49]

At the same time Generals Bragg and Longstreet, from the top of Lookout Mountain, watched the columns march by and go into bivouac. As soon as General Geary's command had gone into bivouac General Longstreet ordered General Law's brigade reinforced by three brigades of General Jenkin's command to occupy, under cover of darkness, the high ground west of Lookout Creek and prevent assistance going to General Geary. One brigade was to attack General Geary's command and one brigade held in reserve on General Law's left. In addition, if possible, General Jenkins was to drive the main body of the Federals back across the Tennessee river.[50]

That night General Bragg approved the plan and made available one other division for the operation, but General Longstreet says the division could not be used as it could not have got to the west side of Lookout Creek before daylight, for the mountain roads were very difficult and the success of the plan depended on a surprise night attack. General Law was therefore given two brigades to hold his position while Jenkins, with the other two, one in reserve, made the main attack on General Geary.[51]

Due to the condition of the roads the Confederates were unable to launch the attack before midnight. It was therefore too late to make any demonstration against the Federal main body. The Confederates had no artillery with Generals Jenkin's and Law's troops and without it they had no desire to leave the command west of Lookout Creek exposed to Federal artillery. General Longstreet says he desired only to inflict such damage against Geary's command as was possible in a night attack and withdraw before daylight.

General Geary's command reached Wauhatchie about 4:30 P. M., October 28, and, knowing they were observed by the Confederates on Lookout Mountain, went into bivouac prepared for all contingencies.[52] General Geary, anticipating an attack, made his strongest dispositions on his south and most exposed flank, expecting the attack to come from that direction. Later he learned that General Longstreet's command was at the foot of Lookout Mountain. He then made provision to repel an attack from the direction of Lookout Mountain and the bridge over Lookout Creek.[53]

About midnight General Jenkins's Brigade, under Colonel Bratton, attacked General Geary from the east.[54] Upon the first firing at the outposts General Geary formed his lines so as to command the railroad and approaches to the right and left. The left of his line was just west of the Kelly's Ferry road and running perpendicular to the railroad. The right of his line was formed at right angles to his center, west of and parallel to the railroad.[55] The Confederates attacked General Geary's left. After a half hour of severe fighting the attack temporarily stopped. The Confederates then prepared to envelop both flanks of the Federal force.[56]

---

[49] 54 RR 57, 97, 105.
[50] 54 RR 97, 105, 217, 218, 225.
[51] 54 RR 223.
[52] 54 RR 115.
[53] 54 RR 113.
[54] 54 RR 231
[55] 54 RR 113, 114.
[56] 54 RR 231, 232.

About 3:00 A. M., October 29, as General Geary's ammunition was about gone, General Law's right was driven back by General Howard's Corps. This forced General Law to withdraw. General Geary was getting ready to use the bayonet, and Colonel Bratton says he was getting on very well when General Law's retirement forced him to withdraw. The Confederate command then withdrew east of Lookout Creek.[57]

When General Hooker heard the firing at Wauhatchie he, at 1:00 A. M., October 29, ordered General Schurz's Division of General Howard's Corps to proceed at once to the aid of General Geary. During the march the right of General Law's forces surprised General Hooker by opening fire on General

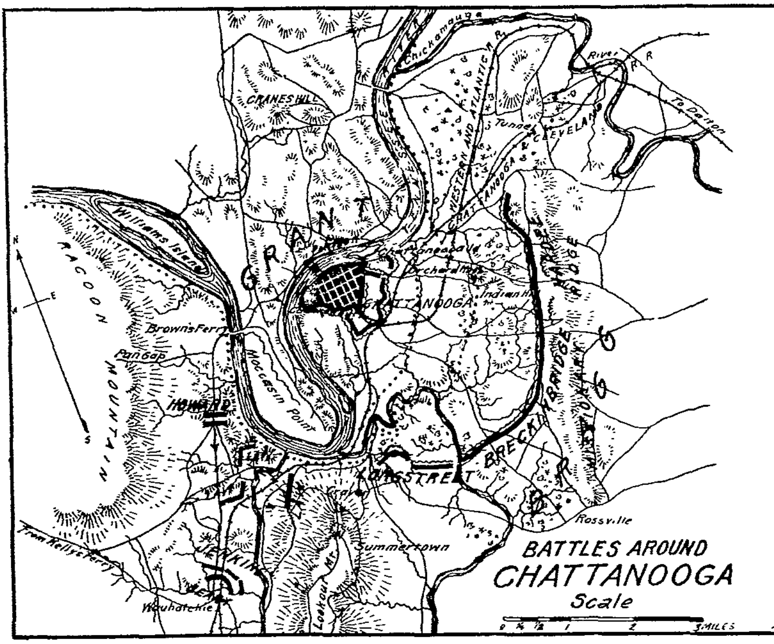


Fig. 4

Schurz's division. General Hooker then ordered one of Schurz's brigades and General Steinwehr's division to drive the enemy back. This surprise resulted in conflicting orders and misunderstanding, the effect of which was that reinforcements did not reach General Geary *until after* 5:00 A. M., *long after the* fight. However, this engagement with General Howard's Corps caused General Law to withdraw, which incidently aided General Geary.[58]

General Palmer's command, under General Cruft, crossed the river at Shellmound and his command, less one brigade at Shellmound, joined General Hooker's command on October 31, 1863.[59]

These maneuvers definitely forced the Confederates east of Lookout Creek and gave the Federals control of the valley and country to the west. The Federals now had open to them two routes of supply from Bridgeport, one by

[57] 54 RR 115, 218, 228, 232.
[58] 54 RR 94-95, 98, 101, 103, 105, 210-211, 228.
[59] 54 RR 82.

water to Kelly's Ferry, thence overland via Brown's Ferry to Chattanooga, a distance of only eight miles by wagon road; the other by wagon road via Whitesides, Wauhatchie, and Brown's Ferry, a distance of twenty-eight miles.[60]

General Longstreet withdrew part of General Law's command on October 25 before the crossing was effected at Brown's Ferry. General Law then had an insufficient force available to prevent the Federal forces from crossing.[61]

General Hooker was advised by General Hazen that his position on the night of October 27 invited attack and was poor for defense.[62]

Shortly after these operations Bragg detached Longstreet with about 20,000 men to operate against Burnside at Knoxville. This detachment reduced Bragg's army to about 35,000 men, while Hooker's and Sherman's arrivals prior to the Battle of Missionary Ridge brought Grant's forces up to about 65,000 men.

III. Operation Preliminary to Battle of Missionary Ridge

By Major Roger B. Colton, C. A. C.

On November 23 Grant ordered Thomas with his Chattanooga troops and with Howard's division to attack Bragg. Thomas attacked, drove in Bragg's outposts, securing Orchard Knob and altogether advancing the Union line about a mile and a half in front of Bragg's Center.

Thomas's attack was ordered as a result of a report by a Confederate deserter that Bragg was withdrawing, whereas actually Bragg was sending reinforcements, under General Cleburne, to Longstreet. As a result of the attack most of Cleburne's troops were recalled and placed in general reserve.

After many delays Sherman, coming from Vicksburg, whence he had started on September 22, crossed the river at Bridgeport and Brown's Ferry on pontoon bridges between the twentieth and twenty-third of November, and by midnight November 23 was in position opposite the mouth of the Chicamauga Creek ready to cross with almost 18,000 men.

The pontoons were assembled in a creek valley up-stream and at midnight were floated down stream, carrying a brigade of men under Smith. This brigade landed both sides of the mouth of the Chicamauga and captured or drove off the Confederate pickets and established a bridgehead.

By daylight Sherman had ferried across 8000 men and by noon he had put across a bridge 1350 feet long.

By 1:00 P. M. he had three of his four divisions across and he had marched in three columns on what he supposed to be the northern end of Missionary Ridge but what was really a small detached hill mass. By 3:30 P. M. he was in possession of the northwestern hill of this hill mass, his advance having been opposed only by pickets.

During the morning of November 24 Bragg learned of Sherman's crossing and sent Cleburne to the Confederate right. A small part of these troops seized the hills in front of Sherman at about the time that Sherman got the north-

[60] 55 RR 28.
[61] 54 RR 224.
[62] 54 RR 72.

western hill. Sherman made no attempt to drive them off. They were reinforced by other troops and were never dislodged.

Battle of Lookout Mountain

General Stevenson held the Confederate line from Chattanooga Creek to Johnson's Crook, about 30 miles, with some 8500 men. The line from Chattanooga Creek to the Summertown Road was held by two brigades of about 3000 men total strength, leaving about 5500 men for the defense of the mountain proper. The troops on the mountain were disposed in part on the plateau and in part on the northern and northwestern slopes of the mountain. The plateau was held with about 2900 men and the northern slopes with about 2600 men. In the vicinity of the Craven House was General Jackson with Moore's and Walthall's brigades.

The forces on the mountain bivouaced near its northern tip. The infantry on the cliff picketted the cliff as far south as Nickajack, while a small amount of attached cavalry (about 150) men picketted the line from Nickajack to Johnson's Creek.

Moore's brigade and Walthall's brigade picketted the line from the Summertown Road along the turnpike to the bridge near the mouth of Lookout Creek, thence south a short distance beyond the railroad bridge, then directly up the mountain slope. Walthall's command bivouaced on the northwestern slope of the mountain, Moore's command near the Craven House.

The Confederate defenses of the mountain consisted of a partially completed line from Lookout Point to the mouth of Chattanooga Creek together with older breast works enclosing the northern nose of the mountain. Walthall held some of the older works on the west side of the mountain paralleling Lookout Creek about one-half mile from the Craven House. His works were dominated by the ledge that extends around the mountain at the foot of the cliff.

Floods and Confederate rafts broke Grant's pontoon bridges on November 23 and left him with 9700 men along Lookout Creek. On the night of November 23 he ordered Hooker, with this mixed command of 9700 men, to attack Lookout Mountain on the morning of November 24.

Starting early in the morning Hooker sent Geary, with 3824 men, south along Lookout Creek to a point about three miles from its mouth where they bridged the creek and effected a crossing without opposition. On crossing the creek they marched straight up the mountain side to the cliff at the crest and then marched north in line of battle with their right on the cliff at the crest and their left on Lookout Creek.

In the meantime, Cruft with about 1600 men established a bridgehead in the vicinity of the railroad bridge over Lookout Creek about a mile south of its mouth. Osterhaus formed in rear of Cruft and by 10:30 A. M. had passed through Cruft and formed line of battle facing east with his right near the railroad bridge.

There was a heavy, though shifting fog over the mountain all day, so the Confederates lost much, if not all, of the advantage of their observation.

Early in the morning Walthall manned his defenses on the west slope of the mountain. When his pickets were attacked he reenforced them, leaving him less than 1000 men in his defenses. Confederate information of the Federal attack was very indefinite but by 10:30 A. M. the Confederates realized that they would soon have to meet a heavy attack and since early morning they had known that the attack was impending.

Geary continued his march down the mountain and at about 10:30 A. M. began to drive in the Confederate pickets on Walthall's left flank. Geary's right was just under the cliff on the flats and advanced rapidly. By the time

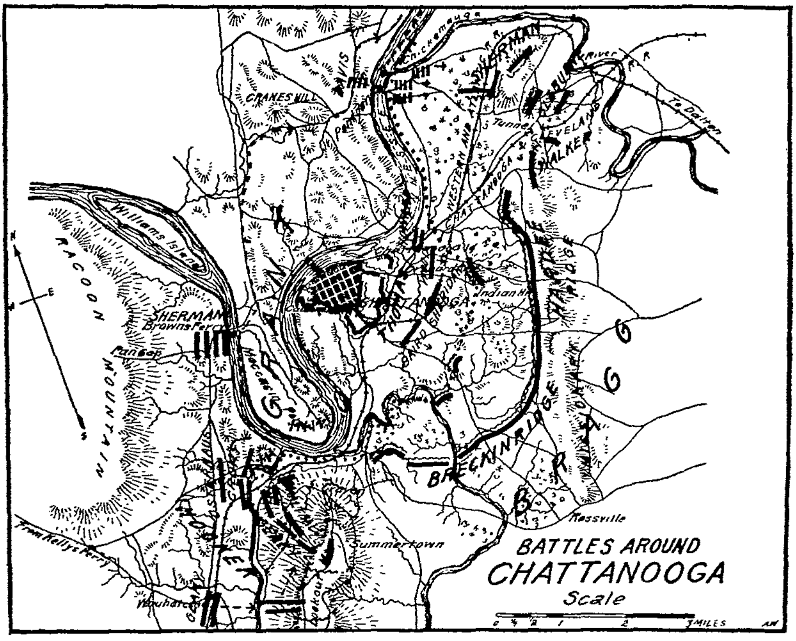


FIG. 5

his center had hit Walthall's left his right was already in Walthall's rear. By 11:00 A. M., Walthall was the focus of the advance of 9600 men and was practically surrounded.

Walthall managed to escape with about 400 men to the vicinity of the Craven House, hotly pursued by Geary. The remainder of his men were killed, wounded, or captured. When Walthall arrived at the Craven House at about 12:30 P. M., Moore manned the defenses thereat.

By this time the Federal forces had already arrived at the Craven House. Moore was driven back but managed to put up some resistance until about 1:00 P. M., when Pettus with about 1400 men arrived from the plateau. The Confederate forces engaged now numbered about 2800 men, with about 1800 in reserve on the plateau not engaged. The Union forces were all on or in support of their front line except Cruft's 1600 men who were still in the valley,

but the brunt of the fighting was borne by Walthall (now reduced to 400 men), Moore (about 1200 men), and Pettus (about 1400 men) on the Confederate side, and Geary with 3600 men on the Union side, all engaged close to the Craven House. At this time Geary was definitely stopped a few hundred yards east of the Craven House and never advanced further during the day, although at just about the time he was stopped his left was reinforced and extended by Osterhaus with several thousand men. During the afternoon Hooker was further reinforced by Carlin's brigade.

Osterhaus began his advance when Geary was close on Walthall's right at 11:00 A. M. and extended Geary's line toward Mocassin Point by about 1:00 P. M., engaging Moore's pickets and the right flank of his main body.

The Federal forces now entrenched their line and made no further effort to advance. Bragg sent up Holtzclaw with a brigade (Clayton's) during the afternoon and at 2:30 P. M. ordered Stevenson to withdraw from the mountain. Holtzclaw took over the lines and covered the withdrawal, withdrawing himself shortly after midnight.

IV. The Battle of Missionary Ridge

By Major Franklin Babcock, I. G. D.

During the night of November 24-25, General Bragg withdrew all the Confederate troops from Lookout Mountain and Chattanooga Valley to Missionary Ridge, where on the morning of the twenty-fifth his new line extended from the Chickamauga River on the north to Rossville Gap on the south, a distance of about six miles.[63] Lieutenant General Hardee had command of the right (north) wing and General Breckinridge of the left (south) wing.[64]

In General Grant's army, General Sherman's troops were just south of the Chickamauga River, with the Tennessee River at their back; General Thomas was in the center, just east of the city of Chattanooga; and General Hooker was on the Union right flank just above the northern shoulder of Lookout Mountain, with Chattanooga Creek between him and Missionary Ridge.[65]

Grant placed his headquarters on Orchard Knob, where he had good observation of the field of battle.[66] His orders for the attack on the morning of the twenty-fifth directed Sherman to advance against the Confederate right wing at daylight and Hooker to move at daylight in an endeavor to intercept the Confederate withdrawal from Lookout Mountain and Chattanooga Valley, provided the troops had not already effected the movement, and then to advance directly to the pass at Rossville Gap and operate against the left and rear of Bragg's army on Missionary Ridge. Thomas was not to attack until Hooker had reached Rossville Gap.[67]

Sherman moved forward at sunrise and, after severe skirmishing, assaulted in two lines at about 10:30 A. M. with a strong attack on Tunnel Hill, defended by the division under General Cleburne.[68] This assault was repulsed at close

[63] 55 RR 34, 664, 748.
[64] 55 RR 664, 665.
[65] 55 RR 24, 33, 664.
[66] 55 RR 34.
[67] 55 RR 96, 317, 574.
[68] 55 RR 575, 665, 749.

range by the Confederates in their breastworks on the hill side. Reinforcements were sent from Thomas's command to support Sherman, giving him six divisions, but repeated and stubborn (but piecemeal) frontal assaults up to 3:00 P. M. were without success because of the strength of the Confederate position, Cleburne's excellent dispositions, and skillful coordination of all elements of defense— *i. e.*, occupation of proper tactical localities, emplacement of artillery, arrangements for mutual support and use of counter attack.[69]

In the meantime, Hooker having been delayed by a Confederate detachment, had not arrived at Rossville with his command to attack the left and flank of

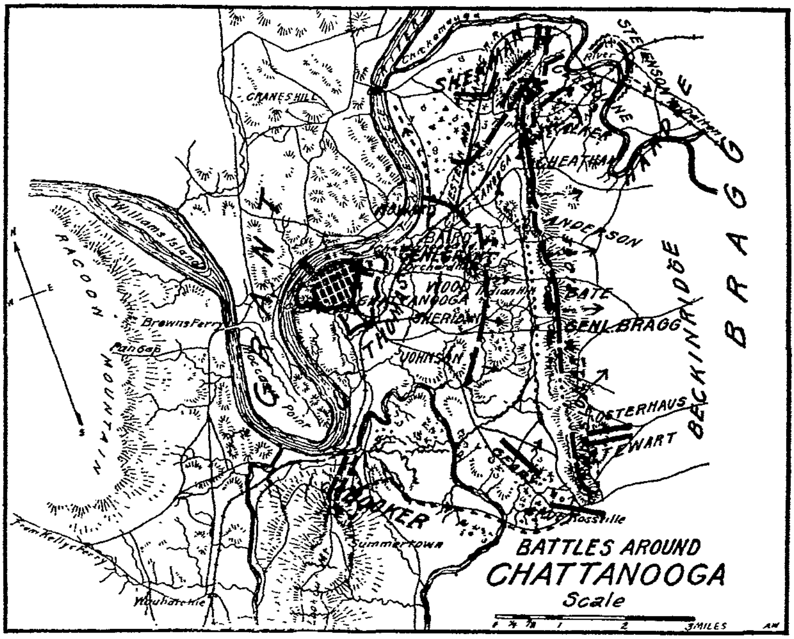


Fig. 6

the Confederate position, and consequently Thomas's troops had remained halted waiting to attack the center.[70] Finally, Grant ordered Thomas to assault with four divisions and capture the first line of entrenchments in his front, and there to halt and await orders.[71]

At 3:30 P. M. Thomas's line of about 30,000 men attacked on a front of two and one-half miles. Missionary Ridge along this line was several hundred feet high, with steep slopes broken by many ravines, and was occupied by the Confederates with about 20,000 men, the main line of resistance being on the crest.[72]

Thomas's assault captured the first line of entrenchments with the bayonet and the troops there halted as ordered but were subjected to severe fire from the trenches above.[73] One after another the regiments continued the assault, without definite orders and soon the whole line was advancing, making by

[69] 55 RR 34, 750.
[70] 55 RR 34, 318.
[71] 55 RR 96, 190.
[72] 55 RR 95, 665, 666.
[73] 55 RR 34, 190.

accident a coordinated attack, whereupon the crest of the ridge was captured, and the center of Bragg's position was won.[74] The Confederates gave way in panic.[75]

Meanwhile, Hooker with three divisions had reached the pass at Rossville. He had been delayed four or five hours due to the necessity of forcing a crossing of Chattanooga Creek against a small Confederate detachment.[76] Upon his arrival, he turned Breckinridge's wing and, almost unopposed, advanced northward, with one division on top of the ridge and one on each side, until he connected with the right of Thomas's line about sunset.[77]

On the Confederate right wing, Hardee moved a division of Cleburne's troops under General Cheatham across and at right angles to the ridge, facing south, and maintained his position and troops intact.[78]

General Bates, under orders from Bragg, placed his division, which was the only Confederate division south of Cheatham's not entirely routed and out of hand, to hold a position covering the roads for the retreat upon the depot at Chickamauga. This he effectually did while the soldiers of the routed left and center made their way to the rear in great disorder.[79]

Hardee was then ordered to withdraw the right of the line which he had held against all of Sherman's attacks. This he did during the night in good order. There was no attempt at pursuit by Sherman during the night.[80]

Upon reaching Chickamauga the Confederate army continued its retreat to Ringgold.[81]

On the morning after the battle, Sherman was sent in pursuit by way of Chickamauga Station, while Hooker marched by way of Ringgold. The country and roads were fully known by the Confederates, but equally unknown by the Union forces, and all bridges over the Chickamauga River were destroyed by the Confederates in their retreat. However, the river was fordable at several places.[82]

The Confederates reached Ringgold, where Clebourne's division checked the Union pursuit on the twenty-seventh. The Confederates then withdrew to Dalton, and the pursuit was suspended on the twenty-eighth at a distance of about twenty miles from Chattanooga.[83]

Grant states: "Had it not been for the imperative necessity of relieving Burnside (at Knoxville) I would have pursued the broken and demoralized retreating enemy as long as supplies could have been found in the country."[84]

The Union army lost 757 killed, 4529 wounded, and 330 missing, total 5616. The Confederate loss in killed and wounded was less than the Union owing to the fact that they were protected by their entrenchments and their panic was soon covered by darkness, but their loss in prisoners was large, amounting to about 5000.[85]

[74] 55 RR 35, 666.
[75] 55 RR 27, 665, 667.
[76] 55 RR 34, 318.
[77] 55 RR 319, 665.
[78] 55 RR 665.
[79] 55 RR 665, 742.
[80] 55 RR 35, 635.
[81] 55 RR 666.
[82] 55 RR 35, 665, 666.
[83] 55 RR 26, 35, 666, 755.
[84] 55 RR 35.
[85] 55 RR 26, 36.

V. Comments

THE SIEGE OF CHATTANOOGA

After the battle of Chicamauga, Bragg, according to the custom of the times, delayed pursuit for a day, allowing Rosecrans to entrench himself in Chattanooga. Thereafter, Bragg, as Longstreet remarks, attempted to starve out Rosecrans by investing him on the only side from which he (Rosecrans) could not get supplies. After a week's delay Bragg sent his cavalry to operate on Rosecran's line of supplies. In the meantime this cavalry had been scattered to the four winds, and Bragg, instead of assembling it for a coordinated operation, ordered it against the Federal communications in three columns. Two of these columns were defeated in detail by the Union cavalry, while the third never moved. The chief reasons for the failure to starve out Rosecrans are therefore obvious.

Bragg's failure to hold Lookout Valley was due to the fact that there was no road leading from the position of the Confederate main body to Lookout Valley.

Jenkin's night attack on Geary depended for success on Law's containing a force three times his strength. It could not be done at this stage of the war.

GRANT'S TACTICS

Thomas's attack on November 23 was too strong to serve the purpose of a reconnaissance in force. If Bragg was really withdrawing he would, in the twenty-four hours that had elapsed between the time of origin of the deserter's information and the time of attack, have already cleared his position by several miles with his main body and a force of 10,000 men would certainly have been able to puncture his rear guard. The remainder of Grant's army could then have been set in motion in the decisive direction. In fact, the attack actually served to cause Bragg to strengthen his forces by the recall of Cleburne, whose entrainment for Knoxville was under way and had originated the report, and whose stubborn defense of the right of the line and later rear guard action probably saved Bragg from annihilation. This attack secured Sherman's river crossing, however, though not made for that purpose, and was therefore, by accident, a sound tactical move.

Hooker's attack was forced on Grant but it should have been, according to the rules of war, postponed until the twenty-fifth. However, its astounding success actually probably served to lower greatly the morale of the Confederate forces as the Union flag on Lookout Mountain was a symbol of disaster that every Confederate on Missionary Ridge could see.

Sherman's river crossing as originally planned by Grant was a hazardous undertaking. Grant did not originally intend to have Thomas attack until Sherman had effected his crossing. With Orchard Knob still in their possession Sherman should have been defeated by the Confederates at the river. It looks as though Grant was trying to repeat Vicksburg on a small scale. Bragg was

too good a general and too aggressive to try such a scheme on. With Orchard Knob in Grant's hands the Confederates could not attack Sherman at the river without exposing themselves to an attack in the flank or rear.

Grant's simplest and best plan would have been to have held Sherman's pontoons in reserve to secure his river crossings and to have concentrated his entire force at Chattanooga and then made a coordinated attack on Bragg, penetrating the Confederate position along the Chattanooga Creek.

Bragg attempted to hold a position which gave the attackers the advantage of interior lines, which should be a chief advantage of the defense. Grant tried his best to give the interior lines back to Bragg but providence intervened.

BATTLE OF LOOKOUT MOUNTAIN

The defeat of the Confederates at Lookout Mountain appears to have been due entirely to poor leadership. It is hard to know where to place the blame because it rests on Bragg, Stevenson, Jackson, Moore, and Walthall, and also on Hardee who was in command of Bragg's left until shortly before the battle.

Walthall's breastworks were so sited that a flank attack took them from the rear from higher ground. The "new" line was so close to the Summertown road that, with an active enemy in its immediate front, the plateau was untenable. The pickets were too far away from the main bodies to be effectively supported. They should have been instructed to fall back at once by a pre-arranged route in case of a general attack, should have been fewer in number, and should have been better sited. During the battle Stevenson passed the buck to Jackson, Jackson passed it to Walthall, and Walthall tried to fight 10,000 men with 1000. Neither Stevenson, Jackson, Moore, nor Walthall appears to have known what the plan of defense was, although they were the men who had to execute it. When they finally formed a line to oppose the advancing Federals, the Confederate soldiers, although outnumbered at the point of contact by about two to one, stopped the attack in about a half hour or hour and within a few hundred yards.

SHERMAN'S RIVER CROSSING

As this crossing was unopposed it reduced itself merely to an excellent piece of engineering.

After the crossing was effected Sherman was too timid. With nearly 18,000 men he marched up to Bragg's flank and waited for Bragg to try to drive him out. An hour's fighting on November 24 would have put him in control of one of Bragg's main lines of retreat. Consequently, he fought all the next day trying to cut off Bragg and was entirely unsuccessful. His failure to seize the complete hill mass north of the tunnel seems to have been due to his astonishment at finding that his map was inaccurate and to a lack (perhaps momentary) of a ready eye for the ground, together with a disposition to let well enough alone.

In this operation Bragg had more success than he deserved. Although he probably did not know Sherman's exact strength he either did or should have

had twelve hours' notice of Sherman's advance and should have had an adequate force on his right flank to protect his line of retreat if he intended ~~to~~ stay put.

THE BATTLE OF MISSIONARY RIDGE

During the battle of Missionary Ridge the Confederates were able to defend successfully their right with 12,000 men under Cleburne (a subordinate of Hardee) against 20,000 men under Sherman because Cleburne had arranged his troops in depth to garrison supporting, but echeloned, tactical localities and had used reserves for counterattack, while Serman attacked repeatedly on a narrow front in piecemeal fashion.

There was a little distance between the Confederate right and center. The center was held by about 20,000 men against Thomas with 30,000 men. The Confederates were, for many reasons, unable to defend successfully the center. The outpost lines were held in too great strength, considering that there was no intention to reinforce them, that there were no covered routes of withdrawal, and that they were apparently ordered to fall back in case of a serious attack. The main position lacked depth, and such depth as it had was not utilized—all troops were placed on one straight line practically along the topographical crest of the ridge. At the time of Thomas's attack the Confederate center had no reserves, either general or local. It was inevitable that if Thomas attacked with 30,000 men he would drive in the Confederate outposts, and that if he then quickly reformed in the rifle pits of these outposts and launched a coordinated attack all along the line, the Confederate line would necessarily be punctured somewhere. Once punctured, the troops making the penetration would necessarily take the Confederate line in flank and rear and roll it up, provided the simultaneous attack was continued all along the line to hold the Confederates in place.

In disobedience of orders the Union troops, after taking the rifle pits of the Confederate outposts, did make a coordinated attack. The men went first and the officers followed and caught up with them. The inevitable happened.

There was a little distance between the Confederate center and left. The left was held by about 4000 men under Stewart. It was attacked by Hooker with 11,000 men, but first Hooker had to force a crossing of the Chattanooga Creek. Hooker's attack at this time and place was logical and undoubtedly expected, yet only a small detachment was used by Bragg to oppose Hooker's advance, and the Confederate left was not refused. Hence, when Hooker finally got over the creek, near sunset and, marching north, took Stewart's 4000 men in flank and rear, they naturally fell back to the north and into the arms of Thomas's 30,000 successful troops. Some then escaped by running to the east.

BRAGG'S CONDUCT OF THE CAMPAIGN

Bragg, by failing to pursue vigorously after Chickamauga, lost his best chance of destroying Rosecran's army. Vigorous and immediate pursuit after Chickamauga would probably have resulted either in the capture of Rosecran's

army or in driving it in complete disorder out of East Tennessee, and Burnside would then have been easy prey. When hours were precious Bragg wasted a day. It was at this time that General Forrest, anxious to pursue, remarked that each hour was worth two thousand men.

Having thus lost his best chance to destroy Rosecran's, Bragg might yet have bagged him had he thrown his cavalry and twenty thousand infantry across the river north of Chattanooga.

Failing to do this, Bragg still might have starved Rosecran's out by sending all his cavalry at once to destroy the Federal communications. When Chicamauga was lost, Union reinforcements were immediately started to Rosecrans. When days were precious Bragg wasted a week before sending out his cavalry and then mismanaged their maneuvers.

Hooker having arrived and Sherman being close at hand, Bragg detached 20,000 of his best men and took up a passive defense. The force detached was not large enough to insure its complete and speedy victory in the task assigned, and the force remaining was not large enough to protect the communications of the force detached. Obviously one or the other should have been made sufficient for its task. Had he retained Longstreet, Grant's 65,000 men would hardly have inflicted a serious defeat upon 55,000 Confederates who, though poorly led, were yet as well led tactically as were the Federals. Had he sent 35,000 men against Burnside's 13,000 he should easily have captured Knoxville and reopened the railroad line from Richmond to Chattanooga.

GRANT'S CONDUCT OF THE CAMPAIGN

Grant's tactics were no better than Bragg's, but in his general conduct of the campaign there is little to criticize. He held on to the ground gained, built up his communications, and brought up his reinforcements as rapidly as possible. With all the War Department and the President urging attack, he nicely calculated the time available and finally, with overwhelming forces, attacked vigorously just in time to save Burnside and East Tennessee. While a more prolonged and stronger pursuit of Bragg after Missionary Ridge might have cost Bragg much, it might also have permitted Longstreet to capture Knoxville.

Hurried preparation for war always means great loss, great loss in efficiency and health.—**V. V. Vaughan, M. D., University of Michigan.**

Colonial Forts of the Gulf Coast

Florida, Alabama, Mississippi, Louisiana, and Texas

THE discovery of Florida must be credited to Juan Ponce de Leon, who, while in search of the "Fountain of Youth," sighted the coasts of Florida on Easter Sunday, March 27, 1512. A week later he landed in the vicinity of St. Augustine, took possession of the country in the name of his sovereign, and began his search for the mythical fountain whose waters could restore old age to the bloom of youth. For two months he searched, but at last he became discouraged and returned to Porto Rico.

From its first discovery, Florida took a firm hold upon the imagination of the Spaniards, whose minds conceived wonderful dreams of immense wealth in cities and mines within its unexplored interior. In 1528 Pamphilo de Narvaez, duly commissioned to conquer and govern Florida, landed near the Bay of Espiritu Santa (Tampa), probably in Clear Water Bay, and spent five months in a fruitless quest for gold and in exploring the country to the north and west. Becoming discouraged, he built boats for his command, embarked his forces near the head of Apalachicola Bay, and sailed for Mexico. Eleven years later Ferdinand de Soto landed about six hundred men in Tampa Bay and traversed the country in a westwardly direction to the Mississippi River, where he died in 1542.

Other expeditions to Florida and the Gulf Coast followed, but for many years, even after the shores of the gulf became well known, the Spaniards made no attempt to establish permanent settlements in the region. These Spanish Conquistadores traveled rough-shod over the country, seeking gold, silver, and precious stones. Leaving death and destruction in their wake, they proved to the world that the wealth of the Gulf Coast lay not in minerals and jewels; and caring nothing for agricultural pursuits, they had not at the end of fifty years a single settlement on the Gulf.

Military occupation was, of course, necessary if the country was to be subdued; and the few settlements which the Spanish undertook were established for the purpose of exploiting the country or for holding the French at a distance. As early as 1558, Philip II, of Spain, instructed Luis de Valesca, Viceroy of New Spain, to undertake the settlement of Florida. Valesca decided upon Pensacola as a satisfactory site for the new colony, and in the summer of 1559 he sent there about fifteen hundred soldiers and settlers. For some unexplained reason the site turned out to be unsatisfactory to the members of the expedition, and the garrison was recalled during the following summer.

After the close of the period of exploration, the Gulf Coast received no attention from Spain until France, working down from Canada by way of the Mississippi, set up a claim to a part of this shore line. It was La Salle who, after descending the Mississippi River, first conceived the idea of establishing

a French colony on the Gulf. He returned to France for that purpose and fitted out a frigate and three other vessels with materials and with about two hundred and eighty men. On the trip across the Atlantic, the ketch *St. Francis* was captured by Spanish privateers, but the three remaining vessels reached the Gulf early in 1685 and began their search for the mouth of the Mississippi. Contrary winds and a lack of knowledge of the gulf water carried La Salle far to the westward and forced him to land, in February, on the coast of Texas.

The frigate *Aimable,* crossing the bar at the entrance of Matagorda Bay, grounded and was wrecked, but the other vessels successfully negotiated the passage and landed the colonists. In March, Beaujeau, commanding the brig *La Belle,* left for France after landing twelve guns for the protection of the community, but he carried away with him much of the ammunition. After his departure, La Salle built a fort at the western extremity of St. Bernard Bay, and garrisoned it with a hundred men. He then began the exploration of the surrounding country and, in April, built a fort on Point Hurier. After Easter the colonists removed to a new location on Garcitas Creek, where a rude post called Fort St. Louis was erected. Here the twelve guns were mounted and a subterranean magazine built.

Early in 1686, the last ship was cast ashore in a hurricane and great quantities of supplies were lost. La Salle thereupon set out on foot with a portion of his command to find the Fort St. Louis of the Illinois—an expedition on which he lost his life. The people left behind at Fort St. Louis received no succor from France, and by 1687 practically all of them had died of disease or starvation.

The passage down the Mississippi by La Salle and his subsequent attempt at the establishment of a colony aroused Spain to the necessity of having more concrete evidence with which to establish her claims to the vast territories of Florida and Louisiana. In all the two hundred years since the voyages of Columbus, Spanish projects at colonization of Florida and the Gulf Coast had been limited to the occupation of a fortified post at St. Augustine and to a few feeble attempts to establish other settlements.

In September, 1690, Count de Calvé sent Francisco Llanis, with a frigate, to explore the Bay of Espiritu Santa (Matagorda) with a view to the location of a fortified base of supplies for priests and soldiers operating in the Province of Texas. Llanis selected a site for a fort on one of the small islands of St. Bernard Bay and reported that the best location for a settlement would be at the place which had been occupied by the French. Captain de Leon, sent to Matagorda Bay with one hundred and ten soldiers and some friars, erected the mission of San Francisco on the site of Fort St. Louis. This place existed for but a few years and was abandoned in 1693.

In 1692 an expedition was sent by the Viceroy of New Spain to explore the harbors on the west coast of Florida, and in 1698 a colony was established at Pensacola, where a small fort was built on the Barranca de Santo Tomé and named Fort San Carlos. This work was built of pine logs in the form of a

square, about a hundred yards on a side, and with four bastions. For armament it was equipped with a battery of sixteen guns.

The wisdom of increased Spanish activity in these regions became apparent in the winter of 1698, when Pierre Le Moyne d'Iberville arrived on the coast with an expedition of two hundred men in two frigates, two smaller vessels, and a fifty-gun ship which had joined him at San Domingo. This expedition had been prepared by Louis XIV of France to plant a colony in Louisiana, to which the French were setting up their claim. Iberville touched at Pensacola, then occupied by about three hundred Spaniards, and sailed thence westward to Biloxi Bay. Arriving at Ship Island in February, 1699, he built huts and tentatively established his colony at that place, while he searched for a more suitable location for permanent occupation. In April he moved most of the colonists to the eastern extremity of the bay, where he built a palisaded fort with four bastions, which was known as Fort Maurepas. Iberville says: "I erected a wooden fort, with four bastions; two are made of hewn timber, placed together, one foot and a half thick, and nine feet high; the other two of double palisades. It is mounted with fifty-four pieces of cannon." By May twelve guns had been mounted under the command of Sauvolle, Iberville's brother. Bienville, another and younger brother, was appointed lieutenant of the fort.

Towards the end of the year, Iberville learned that the English contemplated the establishment of a colony on the Mississippi, so he determined to secure the banks of that river for the French. Setting out in January, 1700, he chose a site about seventeen miles below the site of New Orleans, near English Turn, and began the erection of a fort which he named Fort La Boulaye. He also built and garrisoned a fort on Dauphine Island, below Mobile, and distant about forty miles from the Spaniards at Pensacola.

In 1701, having received instructions to remove his colony from Biloxi to Mobile Bay, Bienville left twenty men at Fort Maurepas and sailed with the rest of his establishment to the mouth of Dog River, where he built a fort in the spring of 1702. The settlement received the name of Mobile, and the fort became Fort St. Louis de la Mobile. This settlement suffered much from the high spring floods, particularly in 1709, and was removed in 1711 to a spot near the present site of Mobile. Here was built a wooden fort, which gave way in a few years to an extensive fortress of brick, with bastions, demi-bastions, half-moon, deep ditches, covered way and glacis, mounting sixteen guns, and called by the French Fort Condé and later, by the English and the Spanish, Fort Charlotte. A small garrison was left at the mouth of Dog River, and that post continued to be manned for several years.

In 1708 an English privateer from Jamaica attacked Dauphine Island, the chief depot of the French, and carried off a considerable amount of valuable supplies.

In 1712 the French had six forts within the territories claimed by them: Fort Boulaye upon the Mississippi River, a fort upon Ship Island, another upon Dauphine Island, Fort Maurepas at Biloxi, Fort St. Louis de la Mobile at

Mobile, and Fort Condé at New Mobile. These forts were all of miserable construction, being made of materials readily at hand, such as stakes, trees, and earth, with portions of them covered with palm leaves. Governor Bienville had been very energetic in his endeavors to insure French control of the region, but he made the mistake of scattering his command among a number of small, widely separated posts, and the equally great mistake of attempting to establish his colony upon a commercial rather than upon an agricultural basis like that of the Atlantic Coast colonies.

In 1713, M. de la Motte Cadillac, the new governor, decided to remove his headquarters from Mobile to Biloxi Bay. Old Biloxi had been accidentally burned, so he erected another fort upon the point of land immediately fronting Ship Island, at a place which was called New Biloxi. The fort was sometimes called Fort Louis. In 1717 a hurricane, sweeping over Dauphine Island, choked the harbor with sand, whereupon Ship Island became the principal depot and place of anchorage. The fort on the island was rebuilt and storehouses were established.

Fort Rosalie, built by the French in about 1716 on a bluff overlooking the Mississippi above New Orleans and intended primarily as an Indian post, was an irregular pentagon, enclosed by palisades, and without any bastions. It was destroyed by the Indians in 1720, but was rebuilt. In 1764 the site was occupied by the British with Fort Panmure. At that time Fort Rosalie was in ruins.

During all the early years of the century, the Spanish continued the inactivity which had characterized the two preceding centuries. Neglectful of their opportunities, they had permitted nothing to disturb the even tenor of their existence at Pensacola. In 1700 the governor had visited Ship Island to protest at the French incursion into Spanish territory, but the voyage was without result and he took no further action. In 1704 Fort San Carlos was burned to the ground and rebuilt as a compact, though small, semi-circular structure, solidly put together. In 1715 a new mission, located further down St. Bernard Bay, was established in place of that of San Francisco in Texas.

By 1717 the extension of French settlements in Louisiana began to cause much uneasiness in Pensacola, and in that year the governor had the defenses strengthened. In the following year, the Spanish built Fort San Marcos de Apalache at St. Mark's, and the French erected Fort Crèvecoeur on St. Joseph's Bay, east of Pensacola. This was too much for the Spanish, and the governor remonstrated to such effect that the French fort was evacuated within a few months. The Spaniards then built a fort upon the site, but soon afterwards abandoned the place.

The rupture between France and Spain first occurred in Europe, but as soon as Governor Serigny at Mobile learned that war had been declared, he decided upon an expedition against Pensacola. Sending some eight hundred Indians by land, he embarked with about four hundred men on three vessels, hoping to capture the Spanish stronghold in a surprise attack. Landing upon Santa Rosa Island, early in 1719, he captured a Spanish outpost. Dressing his men in

Spanish uniforms, he crossed over to the mainland and quickly captured Fort San Carlos. The French account says that they surprised the Spanish commandant in his bed and took the fort without firing a shot; the Spanish account says the fort surrendered after an attack by four French frigates.

Bienville garrisoned the fort with some men under Chateaugné, and then returned to Mobile. The Spanish at Havana fitted out two ships to retake Pensacola. Chateaugné declined to surrender when attacked and a lively engagement followed without a great deal of damage to either contestant. During the night many of the garrison deserted, and on the next day the French commander surrendered.

The Spanish governor immediately strengthened his defenses, "and to give additional defence to the entrance of the port, threw up a little palisade fort on the point of St. Rosa Island." He then set out with two brigantines to attack the French settlement on Dauphine Island, where "there was no fort, retrenchment or other defence, but a battery on the eastern point of the island." The French, although outnumbered, were able to prevent a successful landing on the island, so the Spanish undertook a bombardment of the fort and the town. For four days the garrison of one hundred and sixty Frenchmen and two hundred Indians, aided by one vessel which was anchored near the fort, withstood the attack. The arrival of five French vessels caused the Spanish to return to Pensacola.

With reinforcements, Bienville was now able to prepare another expedition against Pensacola. In September he landed a large force on the perdito and proceeded to assail the town. Upon the appearance of the French and Indians before the fort, the garrison made a show of resistance and then retreated to a new fort, called Principe de Asturias, which they had hastily erected on Point Siguenza. The French vessels having entered the harbor and the Spanish ammunition having been virtually exhausted, the new fort was forced to surrender. For the third time in three months Pensacola changed hands.

The French felt that they could not spare the force necessary to garrison the defenses at Pensacola, so they destroyed the fortifications, burned the town, and returned to Mobile. However, they left behind a guard in charge of one small battery, and Pensacola remained in French possession until after the treaty of peace by which it was restored to Spain. Fort San Carlos was thereupon rebuilt in substantially its modern form; and in 1722 another fort was built on the point of Santa Rosa Island, near the site of Fort Pickens.

The French continued to spread out in all directions by means of their small detached posts. In 1721 a vessel with a small force was sent to occupy Matagorda Bay in Texas and to build a fort. This was done, but the hostility of the Indians soon caused the French detachment to withdraw. The Spanish then located a garrison on the site formerly occupied by La Salle, and called the place Our Lady of Lareto. Ninety men were located there in 1722, but ten years later the number had been halved.

In 1722 Sieur de la Tour established a settlement at Balize at the extreme mouth of the Mississippi, on the southwest passage. Here, on the soft ground,

the French formed a military post, erected a fort on piles, and mounted a battery which covered the anchorage and the entrance to the river. The garrison at this place, usually numbered about fifty men. The magazine and part of the fortifications were swept into the river in 1768, and a new Balize was then established.

Fort Condé, which had been begun at Mobile in about 1717, was completed in about 1722. Substantially built of brick, with four bastions and a large number of casemates, it was far the best fort in Louisiana. Nevertheless, in this year, New Orleans was established and fortified as the capital of the Province.

Notwithstanding the number of forts in French territory, France was nowhere very secure in her possessions. All the garrisons were small and a very limited number were within supporting distance of other forts. Finances were in a parlous state, and no money was available for the maintenance of fortifications. Consequently the forts deteriorated rapidly, and French activity along the coast was much reduced. For forty years very little was accomplished in the line of coast defenses, and the French colonization of the territory advanced so slowly that France finally decided to withdraw from the country on the best terms practicable.

On the tenth of February, 1763, after the conclusion of the French and Indian War, a treaty of peace was signed at Paris. By it all the French possessions in North America eastward of the Mississippi, from its source to the Iberville River and thence by Lakes Maurepas and Ponchartrain to the Gulf of Mexico, were surrendered to Great Britain. At the same time, Spain, with whom England had also been at war, ceded all of East and West Florida to the British Crown. The French possessions west of the Mississippi and the New Orleans area were ceded by France to Spain. England had driven France from the New World as she had already driven Holland. Only Spain and Russia remained.

Fort Condé at Mobile, included with the grant to England, became Fort Charlotte. The forts at Pensacola were called Fort St. Michael and Fort St. Bernard.

Shortly after their occupation of Louisiana, the English built Fort Bute on Point Iberville, where the Iberville River enters the Mississippi. This was, at first, a blockhouse with a small stockaded fort mounting six pieces of artillery and housing comfortably fifty men. In the course of time it became a strong military post and trading center, for it was considered to be "a Post of the utmost Consequence lying Contiguous to New Orleans." A fort at Baton Rouge was also garrisoned by a detachment of soldiers sent by Governor George Johnston of West Florida.

At the outbreak of the Revolutionary War, Fort Charlotte and the forts at Pensacola were the only forts of any consequence on the Gulf Coast, but even these were in a dilapidated condition. Fort Charlotte, at Mobile, was a square of about ninety yards on each front, with four bastions. The scarp wall and the parapet were built of brick, the scarp being about sixteen feet from the bottom to the cordon, with the parapet rising a little over four feet above the

cordon. Under the ramparts of the curtains of the three fronts were small casemates arched with brick. A glacis and a covered way surrounded the fort. The embrasures needed repairs, and the walls and casemates required new facing—the latter particularly, for they were "much out of repair and let in Rain." The sleepers of the platforms being rotten, some needed "entirely to be new Laid and others to be repaired with Planks."

The fort at Pensacola was tetragonal in form, with salients at corner. At each angle a small round tower projected a story above the curtains and mounted the smaller guns. The fort at Santa Rosa Island covered the entrance to the harbor.

When hostilities broke out between England and Spain in 1779, Don Bernardo de Galvez, Governor of Louisiana, invested the English fort at Baton Rouge, which was in West Florida. Lieutenant Colonel Dickson, in command, found himself unable to resist the enemy's forces, and surrendered to Galvez.

In 1781 Governor Galvez and Admiral Salamo laid siege to Pensacola. The place was strongly fortified, and held by a thousand men under the command of General Campbell. The English bravely defended Forts St. Michael and St. Bernard for a long time against the Spanish bombardment, but an unlucky accident caused the explosion of a magazine of Fort St. Michael. The explosion carried away a part of the wall of the principal redoubt and resulted in the capture of the fort. Realizing that the loss of Fort St. Michael rendered Fort St. Bernard untenable, General Campbell did not await the Spanish assault, but capitulated with honorable terms.

The treaty of peace between Great Britain and the United States, signed in 1783, surrendered all territory east of the mississippi between the Great Lakes and Florida, and set the southern boundary of the United States at the thirty-first degree of North latitude from the Mississippi to the Chatahouchee River, thence to the Flint, thence to the head of St. Mary's, and down that stream to the sea. England had not then long held possession of Florida and had recently had some of that territory taken by force. She was not, therefore, particularly reluctant to part with the country, and so, without defining boundaries, she ceded Florida to Spain. The boundary dispute thus opened up, continued for a dozen years, Spain claiming that England was not in *de facto* possession of West Florida and could therefore confer no title to any portion of it. The United States ultimately won the dispute, and a treaty was signed in 1795 confirming the boundary line agreed to between the United States and Great Britain.

In 1793 Governor Cardonelet, governor of Louisiana, strengthened the defenses of New Orleans. The fortifications which the French had placed around the city had decayed, so the governor planned a new system. Southeast and immediately above the city Fort St. Louis was built upon the river, while Fort St. Charles was erected immediately below at the northeast corner. Fort St. Ferdinand, a strong redoubt, was erected at the rear opposite the center of the city, with Fort St. John and Fort Burgundy at the northwest and southwest angles, respectively. These works were connected by deep ditches, and a battery was placed at the center of each flank of the town. The batteries constructed by

the French at English Turn were abandoned, and Fort St. Philip was erected on Plaquemines, with a small fort on the opposite side of the river.

In 1800 Spain ceded Louisiana to France, reserving to herself the Province of Florida, and in 1803 Napoleon sold Louisiana to the United States for fifteen million dollars. The coast forts obtained by the Louisiana Purchase were few in number and were in poor condition. At Baton Rouge there was a poorly constructed fort with a garrison of about fifty men. Behind New Orleans, on Lake Ponchartrain, at the mouth of the Bayou St. John, seven or eight miles from the city was a small work, called Fort St. John, which commanded the approach to the city from the lake. New Orleans itself was defended by five poorly constructed redoubts fast going to decay.

Fort St. Philip was thirty-two nautical miles from the Gulf on the eastern side of the Mississippi, and was an irregular work of brick. It was built on a bend in the river where ships, sailing up to New Orleans, would have to anchor because the turn was so sharp that a wind which would bring a vessel to the bend would be contrary on the next stretch. Like the other works, Fort St. Philip was in a ruinous condition. Across the river, and about a mile above the site of Fort St. Philip, were the ruins of a small closed redoubt, called Fort Bourbon. It had been intended to cover the flank of Fort St. Philip.

Following the Louisiana purchase, the western boundary line of Florida remained in dispute for a number of years, the Spanish retaining possession of Mobile. In 1813 General Wilkinson left New Orleans with six hundred men and sailed for Mobile. Landing his men, he took up a position in rear of Fort Charlotte and demanded its surrender. Captain Cayetano Perez, after some correspondence, capitulated and took his inadequate garrison to Pensacola. Wilkinson then sent nine guns to Mobile Point, where Captain Chamberlain erected Fort Bowyer. The following year the fort was dismantled by the orders of General Flournoy, who considered that it was not capable of defense. General Jackson, however, after his arrival at Mobile in August, decided to regarrison it.

During the progress of the War of 1812, the Spanish authorities of Florida sympathized with the British, who made use of Spanish territory as rendezvous for British vessels and troops. The American occupation of Mobile proved to be a considerable obstacle to the operations of the British in Louisiana, so in August, 1814, a British fleet was allowed by the commandant at Pensacola to use that post for the purpose of fitting out an expedition against Fort Bowyer. With the assent of Governor Manrequez, the British troops landed under Colonel Nichols and were quartered in Forts Barrancas and St. Michael, over which the British flag was raised. General Jackson remonstrated with the Spaniards, but received no satisfaction.

In September the expedition against Fort Bowyer sailed. Commodore Perry, with two sloops and two brigs, carrying thirteen hundred men and ninety-two guns, attacked the defenses on Mobile Point. The garrison of one hundred and twenty men, with twenty guns, under Major Lawrence, so gallantly defended their position that the attacking force was repulsed, and one of

the ships sunk. Disheartened, the British command returned to Pensacola.

Determined to counteract the British occupation of Pensacola, Jackson marched against that city in November with a force of five thousand Tennessee volunteers and a large body of Indians. In addition to the forts, the city was at that time protected by several batteries and by seven vessels of war which were in the harbor. Jackson advanced in a direct assault and the town was soon captured. Colonel Nichols, hard pressed by the Americans, blew up Fort Barrancas and escaped with his troops and his Indian allies to the vessels, which at once put to sea. General Jackson held the town but two days. Destroying the fortifications, he withdrew to New Orleans, while the Spanish Governor immediately commenced rebuilding the defenses of Pensacola.

During the Battle of New Orleans and the events preliminary to it, the British fleet was in action on the Mississippi. Some vessels bombarded Fort St. Philip, below New Orleans, on the 11th of January, 1815, and continued the attack for eight days without success. This failure, combined with the American victory on land, forced the British to withdraw from the Mississippi. Turning their attention to Mobile, they assembled a large naval force off Fort Bowyer and landed five thousand men in the vicinity. Twenty-five vessels anchored in a semi-circular position five miles in front of the fort, and thirteen ships-of-the-line took station two miles in rear of it. The Americans decided that the attacking force was overwhelming and, in February, surrendered Fort Bowyer to the British, who retained possession only until the first of April.

During the war with the Seminole Indians in 1817, it was ascertained that the Indians were incited to hostilities by British subjects, protected by the Spanish authorities in Florida. General Gaines, in March, 1818, invaded Florida, took possession of the weak Spanish post of St. Mark's, at the head of Apalachee Bay, and sent the civil authorities and troops to Pensacola. Jackson soon afterward marched on Pensacola. Upon his arrival, the Spanish governor fled on horseback to Fort Barrancas, at the entrance to Pensacola Bay. Here, when threatened by the American troops, he made some slight show of resistance and then surrendered. The United States were now in a position to make terms with Spain, and early in 1819, that nation ceded Florida to the United States. The treaty, which was ratified in 1821, confirmed the possession of the United States to most of the Gulf Coast, and set the Sabine River as the boundary line between the United States and Texas.

This latter province, largely unsettled along its uninviting shores, had never possessed coast forts of any consequence. Galveston Bay had been discovered by the colony of La Salle in 1686, but for many years it had remained deserted. It then became a stronghold for free-booters and smugglers. These were driven from the town, which then became a center for revolutionists. In 1819 a detachment of the Republican Army under General Long took possession of Bolivar point and there erected a fort which was known as Fort Bolivar.

In 1831 two other forts had been built in the vicinity. When the Mexican government established custom houses in Texas and undertook to collect duties, the collector of the "port of Galveston" lived near the mouth of the Trinity

River at the head of Galveston Bay. At this point, Colonel Blackburn, in 1831, had a fort erected to guard the land from surveyors and to protect the port from smugglers. This work was called Fort Anahuac.

A little further down the coast, at the mouth of the Brazos River, there was built Fort Velasco. This work, circular in form, was made of logs and sand, with strong stakes sharpened and placed close together all around the embankment. In the center, considerably higher than the outer wall, stood a bastion on which was mounted a nine-pounder. Lieutenant Colonel Dominic Ugartacha, in command, was given a garrison of about one hundred and thirty men.

In connection with the Texas struggle for independence, Captain John Austin of the Texas forces attacked Fort Velasco in June, 1832. With a detachment of one hundred and twelve men, and with the assistance of a schooner mounting one light gun, he managed to capture the fort.

By 1836 the Texan forts were valueless. Speaking of Fort Anachuac, the diary of a traveler states that the fort was, in that year, "dilapidated." It was in this year that Texas succeeded in her struggle with Mexico, and became a separate country. For years the Texans had been too busily engaged along their southern border to be concerned with coast fortifications. Soon it became unnecessary for them to consider possible international complications, for, in 1845, Texas was annexed to the United States. By this act of annexation the United States completed their acquisition of territory along the Gulf Coast, the southern boundary being fixed on the Rio Grande River by the War with Mexico.

Of all the forts built on the Gulf Coast, two alone were taken over by the United States in a more or less serviceable condition. Fort Barrancas at Pensacola and Fort St. Philip on the Mississippi had been built with some idea of permanency and could be utilized. The provision of any additional defenses which might be necessary for the future protection of these southern provinces now became a duty of the United States, a responsibility which they readily accepted as accompanying the increase in the territory of the nation. From an original coast line extending from Georgia to Maine, the shores of the United States had vastly lengthened, and now included all the coast from the St. Croix River on the north to the Rio Grande on the south. The United States were beginning to achieve their destiny.

REFERENCES

Avery, Elroy M. A History of the United States and Its People. Volumes I and III. (Cleveland, 1905-07.)

Claiborne, John F. H. Mississippi, As a Province, Territory and State. (Jackson, 1880.)

Clark, Robert C. The Beginnings of Texas, 1684-1718. (Austin, 1907.)

Cox, Isaac J. The West Florida Controversy, 1798-1813. (Baltimore, 1918.)

De Morgues, Jacques le M. Narrative of Le Moyne, Surnamed De Morgues. (Boston, 1875.)

Department of State. An Account of Louisiana. (Philadelphia, 1803.)

Dunn, William E. Spanish and French Rivalry In the Gulf Region of the United States, 1678-1702. Austin, 1917.)

Du Pratz, Le Page. The History of Louisiana. Volume I. (London, 1763.)

Fairbanks, George R. History of Florida. (Philadelphia, 1871.)

French, B. F. Historical Collections of Louisiana. Part Fifth. (New York, 1853.)

Hammond, John M. Quaint and Historic Forts of North America. (Philadelphia, 1915.)

Hodder, Frank H. Pittman's European Settlements on the Mississippi. (Cleveland, 1906.)
Johnson, Frank W. A History of Texas and Texans. Volumes I and II. (Chicago, 1914.)
Kennedy, William. Texas. 2 Volumes. (London, 1841.)
Lossing, Benson J. A Centennial Edition of the History of the United States. (Syracuse, 1875.)
Lowry and McCardle. A History of Mississippi. (Jackson, 1891.)
Marbois, Barbé. The History of Louisiana. (Philadelphia, 1830.)
Martin, François-Xavier. The History of Louisiana. (New Orleans, 1882.)
Pickett, Albert J. History of Alabama. 2 Volumes. (Charleston, 1851.)
Pittman, Philip. The Present State of the European Settlements on the Mississippi. Reprint of the London Edition of 1770, ed. by Frank H. Hodder. (Cleveland, 1906.)
Reynolds, Francis J. The New World Atlas and Gazeteer. (New York, 1921.)
Ridpath, John C. History of the World. Volume III. (New York, 1897.)
Rowland, Dunbar. Encyclopedia of Mississippi History. Volume I. (Madison, 1907.)
Rowland, Dunbar. Mississippi Provincial Archives. Volume I. (Nashville, 1911.)
Shipp, Barnard. The History of Hernardo de Soto and Florida. (Philadelphia, 1881.)
Spears, John R., and Clark, Alonzo H. A History of the Mississippi Valley. (New York, 1903.)
Stork, William. A Description of East Florida. (London, 1769.)
Wallace, Joseph. The History of Illinois and Louisiana Under the French Rule. (Cincinnati, 1893.)
Williams, John L. The Territory of Florida. (New York, 1837.)
Winsor, Justin. The Mississippi Basin. (Boston, 1895.)
Yoakum, Henderson K. History of Texas. 2 Volumes. (Redfield, 1856.)

Military training has an important value entirely apart from its actual military value. This is conclusively proven in the numerous military schools of the United States. The majority of these schools disclaim any attempt to train soldiers, but include military training merely to make better citizens. They find that the man trained militarily learns obedience, promptness, cleanliness, orderliness, coolness, and secures that priceless asset known as executive ability —the ability to make others obey.—Richard Stockton, Jr.

Ships on the Battlefield

By Major C. C. Benson, Cavalry

Editor's Note: *In this article the author discusses a subject which is, or should be, of outstanding interest to the Coast Artilleryman. The main theme is directed toward the necessity of modification of battlefield tactics to allow for the presence of large fast tanks with either or both sides. To illustrate his point, the author selects a situation from one of the current publications, adds tanks to one side, and discusses the consequent effect upon dispositions and developments. Quoting from the text, he shows the applicability of principles and the inapplicability of methods of today.*

The article is not a criticism of our present-day teachings, for no school can be expected to base its teaching today upon tomorrow's probabilities. It is merely an attempt to show wherein we must change our instruction and study.

The author neglects motorization—the mechanical substitute for cavalry—and the tankette or light tank—the mechanical substitute for infantry. Feeling that these are factors of importance, the Journal *pursues the subject on the editorial page, although it is expected that the author will himself continue the discussion of mechanization and motorization in later articles.*

The unresting progress of mankind causes continual change in the weapons; and with that must come a continual change in the manner of fighting,—in the handling of troops or ships on the battlefield.—Mahan.

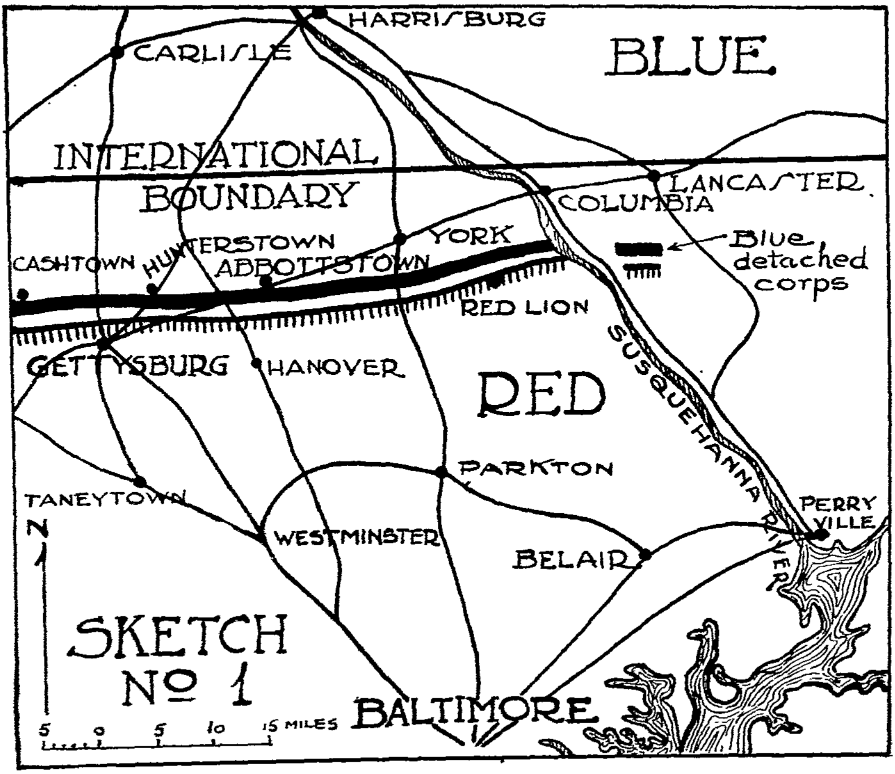
Unresting progress has given the Army a new weapon—the fast cross-country fighting machine. The new light tank (T1 E1), which was developed last year and is now undergoing service tests, maneuvers over rolling terrain at surprising speed. Last October a platoon of these tanks, moving under their own power, made a road march of 144 miles in two and a half days. In November, the new Christie machine covered the same distance in half a day—144 miles between breakfast and lunch. The Christie's amazing ability on the road, across country, and over obstacles leaves small doubt about its development into a first-class fighting machine. It has both strategical and tactical mobility; its iron lungs and steel muscles give it power to carry on where men and horses would drop from exhaustion. This combination of sustained high speed, fire power, crushing power, and ability to advance rapidly across country under machine-gun fire is dangerous—so dangerous, in fact, that we cannot afford to ignore it.

What effect will these fast fighting ships have on the battlefield? We have seen the development of another highly mobile weapon—the airship—and have noted the strenuous efforts made to perfect it for military use. As yet its place in the combat team is undetermined, but the fact stands out that when hostile air fleets engage each other, their direct effect upon ground troops ceases. Landships, however, will fight in actual physical contact with men on the ground. The scene of action, instead of being far aloft, may be in the midst of ground forces. When land fleets engage on terrain occupied by other troops,

Note: By special arrangement with the editors, this article appears in the March issues of publications other than the Coast Artillery Journal.

infantry and cavalry formations will be shattered, artillery positions overrun, signal communications disrupted, command posts isolated, and all semblance of order lost—unless we devise ways and means to neutralize this terrible new weapon. Regardless of what tactics the landships adopt, *their presence on the battlefield will necessitate drastic changes in the present combat tactics of infantry and cavalry.*

To provide specific data for a discussion of these ideas, let us turn to the current teachings of the General Service Schools. The series of studies included in *The Detached Corps* presents a situation (Chapter V) that is particularly well suited to our purpose. The situation is briefly as follows:

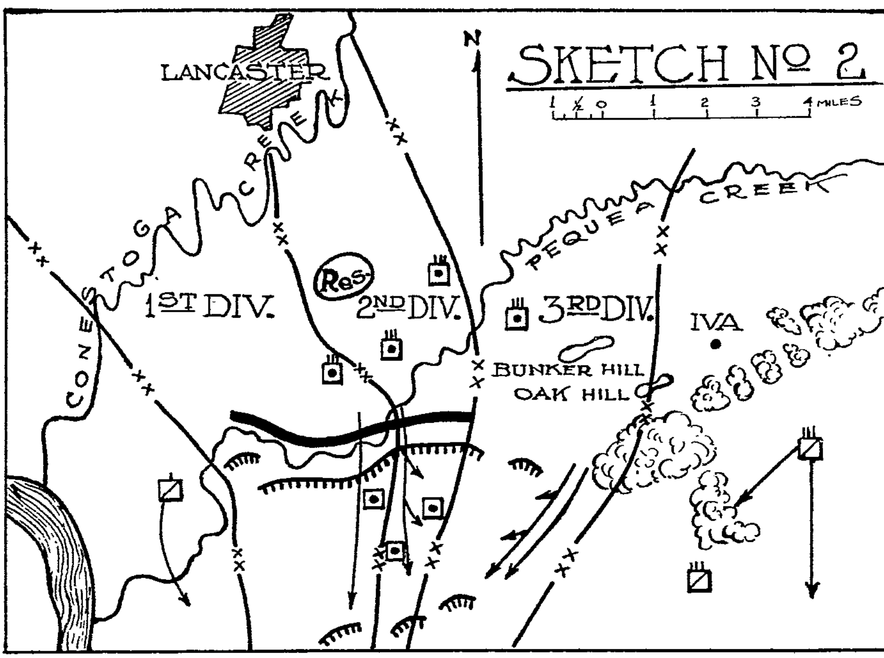


War was declared thirty-six hours ago. The Blue army (north), moving south into enemy territory, is in contact with the Red army, as shown in Sketch No. 1.

The Detached Corps (Blue I Corps), operating east of the Susquehanna River, sent its leading elements across the border near Lancaster early yesterday. It has orders: (a) to cover the left flank of the Blue army; (b) to be prepared to act offensively against the right flank of the Red army; (c) to prevent an advance by the Reds north of a given line. The Blue corps has three infantry divisions; a full complement of corps artillery; a reinforced regiment of

cavalry; and organic air forces reinforced by one pursuit group, one attack squadron, one airdrome company, and one bombardment squadron. The Blues have pushed back Red covering detachments, and have definitely located an intenched position occupied by the Red main body. The Corps is concentrated for an attack which will be launched at 4:30 A. M. tomorrow in an effort to envelop the east flank of the Reds, as shown in Sketch No. 2.

The Reds have two divisions, a regiment of cavalry on the east flank, observation planes, and the prospect of reinforcement from a division which at noon today was camped at Perryville, 30 miles away. The stage is now set for action.



Before we raise the curtain on the events of this drama, it will be necessary to examine some aspects of the contestants' pre-war military policies. The Blues had developed air forces which enabled them to state with assurance, "The Red air service is known to be weak." Air-mindedness, however, had led the Blues to neglect armored vehicles for fighting on the ground. At the outbreak of war, the Blues had only three weak infantry tank battalions, equipped with ten-year-old machines, and a few scattered divisional tank companies, similarly equipped with slow cumbersome tanks. Maneuvers in which these obsolete machines participated had misled the Blues; their training regulations were based on conceptions which gave tanks an extremely restricted role—and mistakenly

assumed a similar role for enemy tanks. On all matters pertaining to the movement, supply, and tactical use of armored vehicles, the war record of the Blues maintains a complete and eloquent silence.

The Reds had candidly recognized the value of fighting machines for ground troops. The Red Tank Corps, supported by consistently adequate appropriations, had fostered the development of improved machines, and had trained other Red forces in the tactical use of the new weapon. Suitable reserves of mechanized troops had been organized and partially trained. Educational orders placed with commercial concerns had prepared for war production of fighting machines for ground troops. At the outbreak of war, the Red Tank Corps had two mechanized brigades fully equipped with modern vehicles and ready for action. Each brigade had one regiment of fast tanks (130 fighting machines), one regiment of mechanized artillery, one battalion of mechanized infantry, armored cars, and various auxiliary units. Unknown to the Blues, the 1st Red Mechanized Brigade moved last night to Baltimore.

We may now return to the battlefield. Darkness has fallen. The Blues are moving masses of infantry and artillery into their final positions for the attack; the Reds are strengthening their defenses. The Red commander, however, is not willing to maintain a passive defense; he is preparing offensive measures to thwart the Blue attack. In response to his urgent requests, Red GHQ has attached the 1st Red Mechanized Brigade to his command. That Brigade, with an escort of Red pursuit planes, is now moving from Baltimore to the battle area.

Can it get there in time to change the situation? The distance to be covered is less than seventy-five miles. Under the conditions of the problem, the Reds will have to cross the Susquehanna River at Perryville. Beyond that point, a network of suitable roads is available for movement to the battle area. Three hours will be sufficient for high-powered machines of the Christie type, traveling on wheels, to cover the first sixty miles. A halt to refuel the machines, adjust caterpillar tracks, and to issue orders for the approach march, will consume another hour. An allowance of three hours more for the last fifteen miles is liberal, because the Reds are operating in friendly country where reliable guides are available. So far as time, space, and roads are concerned, the Red Mechanized Brigade can easily reach the battlefield before the Blue attack is launched.

If Blue observation planes discover and report the Red movement, their reports will have little effect. The Blue main forces are so nearly committed to action that any change in their orders will disrupt the whole plan. Blue air forces may attempt to hinder the Red advance, but they will have extreme difficulty in locating profitable targets, and will have to contend with the Red pursuit planes. The Blues will pay a heavy price for any damage that they may do tonight to the Mechanized Brigade; the net result will be to reduce the effectiveness of the Blue air forces for employment in the forthcoming battle. The Blue cavalry regiment, which has been providing security for the east flank, is the only force in position to obstruct a Red advance against the left and rear

of the Blue corps. To expect this regiment to stop the advance of 130 tanks is absurd. Fast tanks of the Red advance guard, advancing on a ten-mile front, will locate the regimental bivouac and rip into it before cavalry patrols can give warning. Galloping messengers from distant patrols, if not run down by the machines, will serve merely to guide the Red tanks directly into camp. A single tank in that area, running wild over shelter tents and through picket lines, will stampede the regiment. For the time being, the regiment will cease to exist as an effective force.

To brush this cavalry regiment aside may seem fantastic. Surely the Blue cavalry could do something to check the Red Mechanized Brigade! Suppose the demonstration regiment of our Cavalry School is placed in a similar situation. The enemy's advance is unexpected; it comes with such power and speed that there is little time for concerted action. What would the regiment do? What would any of our other cavalry regiments do to meet the advance of a mechanized force? We must find a satisfactory answer to that question.

The security measures of the Blue corps commander are apparently faulty—right in principle, but wrong in method. The principle, as stated in Chapter IV of *The Detached Corps*, is as follows: "The tactical concentration must be covered by a force of such strength and maneuvering power that the movements of the other elements will not be interrupted—." Had the Blue commander supplied his cavalry with armored cars, surprise would have been less probable; if he had possessed a mobile reserve of fast tanks and had known how to use them, the Red advance could have been blocked. Responsibility for the security of large forces rests largely upon the cavalry; consequently, *cavalry should be the first to recognize, teach, and apply the improved methods that fast cross-country fighting machines will provide.*

As a result of the failure of the Blue security measures, the Red Mechanized Brigade issued from the northern edge of the woods near Iva at 4:00 A. M. It deployed in battle formation, sent its infantry to secure Oak Hill and Bunker Hill, and attacked the left flank and rear of the Blue corps. For the purposes of this article it is unnecessary to go into the details of subsequent events. At this point, however, it may be worth while to refer to the Battle of Amiens, which was fought in August, 1918. The report of General Ludendorf on the failure of the German army to hold its ground, stated: ". . . the troops were surprised by the massed attack of tanks, and lost their heads when the tanks suddenly appeared behind them . . ." The German Crown Prince said: "Large numbers of tanks . . . rapidly attacked battery positions and headquarters of divisions. In many cases no defense could be made in time against the tanks, which attacked from all sides. Antitank defense must now be developed to deal with such situations." In passing we may note that the detached corps of 1929 is no more prepared to meet the new weapon than were the Germans in 1918.

The present combat tactics of the infantry apparently need overhauling. Among the principles stated in Chapter IV (The Corps Concentrates to Attack) of *The Detached Corps* is the following: "The cencentration should not be

started until it is reasonably certain that the enemy situation has taken such definite shape as to warrant the adoption of a scheme of maneuver. . . ." In Chapter V (The Corps Attacks), "An early decision usually is necessary in order to retain the initiative, or to strike the enemy before he can fully organize his position or receive reinforcements. . . . Before the attack can be planned in detail, the commander must have accurate information of the location, strength, and limits of the enemy's position." Mechanized forces, which combine sustained speed with tremendous hitting power, introduces a liquid element into an otherwise stable situation. They can, as we have seen, completely alter a situation in less than twelve hours. The Blue corps commander decided to attack thirty-six hours before his attack could be launched—ample time for the Reds to concentrate against him all their mechanized forces within 200 miles of the threatened point. Fairly accurate information about intrenched enemy forces can be secured as heretofore; but how can a commander determine the strength, location, and probable intentions of highly mobile mechanized units that the enemy holds in reserve? Only by continuing to ignore the powers of a mechanized force can we justify the statement, "The corps commander is thus assured that there will be no material change in the enemy situation during the development and deployment of his corps." New time and space factors, commensurate with the mobility of the new weapon, must henceforth be applied to the movement of ground troops. Large infantry units must accelerate their development and deployment or else gamble on the inactivity of hostile mechanized forces.

Another passage in Chapter V of *The Detached Corps* reads: "Surprise is an essential element of success. . . . With a large force, the surprise element of an attack generally is limited to the exact location, the strength, and the direction of the main effort." Against an enemy who holds fast powerful mechanized units in reserve, effective surprise by infantry becomes impossible. The enemy can concentrate his mechanized forces at the critical point long before our slow-moving infantry formations can apply dangerous pressure. Power in our main effort is not in itself sufficient; we must now have both power and speed. Unless infantry can devise ways to deliver its blows rapidly, it must forego the essential element of surprise. *The necessity for speed in development, in deployment, and in the attack indicates that the infantry must change its present combat tactics.*

How can the necessary changes be determined? First, we must have a clear statement of the probable uses and general characteristics of a mechanized force. The War Department can readily formulate this statement from data now at hand. Second, the Infantry School, the Cavalry School, and the General Service Schools can inject mechanized forces into their problems, just as is done with Air Divisions, and thus submit the subject to intensive study. The detailed solution of a single map problem in which the Reds have mechanized forces and the Blues have none would focus the attention of infantry and cavalry officers upon the need for new defensive tactics. Third, the Tank School can make a special study of the combat tactics of mechanized forces. This study

would help other service schools to estimate the situation more accurately. The above measures are practicable and can be put into effect at once without expense. Why wait for battle experience to impress upon us facts that we can learn now by study

The fast cross-country fighting machine is not a Jules Verne forecast of the future; it is a present reality. A reliable machine that we can depend upon to do all that this article implies, and more, has been built. If necessary, a thousand similar machines could be produced within the next six months. There is, however, a big gap between the invention of a new weapon and its application to battle conditions. One man invents the weapon; thousands must learn to use it. How to use ships on the battlefield and how to defend against them are problems which challenge the best brains in our Army. Changes in tactics, far more radical than those caused by aircraft, have got to come.

As pioneers, Army men conducted nearly all preliminary explorations in the early days of our history. They constructed roads, built bridges and canals, made maps and surveys of the great West, and afforded protection to early settlers. Up to 1855, there was scarcely a railroad in this country that was not projected, built, and operated in large part by the Army, while it projected practically all of the transcontinental railroads. The Army built the old Cumberland Pike running from Cumberland, Maryland, to St. Louis, Missouri, which was the most effective influence in opening up the Middle West. Its work includes the construction of lighthouses along our coast line as well as the deepening of important harbors and waterways.—Gen. John J. Pershing.

The Weak Spot in Military Progress

By Major Ralph E. Jones, Infantry

A farmer has no plow. He has a spade and a rake. He is ambitious and energetic. But he has no plow. Of course his work lags. The casual observer remarks, "The farmer is lazy. Look at the amount of his land that is not planted!" But the casual observer is unjust. He does not know that the farmer has no plow.

So it is with the weak spot in our military progress. We have no plow. *Our Army is lacking a suitable agency for general research, experimentation, and development.* We have supply agencies, and some of them (or all of them) have experimental and development sections for certain purposes. We have branch boards (Infantry Board, Tank Board, Air Corps Board, Cavalry Board, Field Artillery Board, Coast Artillery Board, and so on) each of which can make studies, within limits. But these minor agencies are severely limited as to what they may do, and they have, individually, scant resources with which to operate. And, most important of all, they are isolated one from the other. These spades, rakes, and other tools are of course better than nothing, but they cannot do the work for which the plow is needed. Criticism that attributes our slow progress to ultra-conservatism is unjust. The fault lies not there, but in the lack of a suitable agency. The missing element should be supplied.

This research and development organization that we need should include, under one chief, officers of the forward-minded type from all branches. It should have authority to call on certain troops from all arms for experiments and tests. It should have shops and mechanics available in liberal measure, and, of course, adequate funds for miscellaneous purchases, experiments, and the like. It should be responsible for developments and improvements in such matters as organization, tactics, arms, equipment, and methods of training and administration. It should, of course, consolidate and systematize the records of development and improvement projects. It should develop a systematic history of such matters, and thus in many cases avoid unnecessary duplication of effort. It should have cordial and cooperative relationships with the branches and the services. It should naturally not relieve the latter of any of their procurement, manufacturing, or supply functions, but it should take over from them their duties of devising new types of equipment. And it should take over, partially at least, the present duties of the branch boards. It should, in short, serve as a clearing house for progressive military ideas.

Although such an organization would improve the efficiency of minor investigations, it is in the many places where coordination is necessary that its tremendous value would lie. This includes coordination between the activities of cooperative branches and coordination between means and method. In inter-

Note: By special arrangement between the author and the editors, this article appears in the March numbers of publications other than the Coast Artillery Journal.

branch tactics, there is room for extensive developments of this kind; for example, between the Air Corps and any one of the other arms. We seem to be partly unconscious of the intimate relationship between means and method. In the proper investigation of tentative improvements in tactics, needs will arise for experimental equipment. Conversely, in designing new equipment, the minor details of tactical use may constitute governing considerations of no small weight. Let us rid ourselves of haphazard, isolated, duplicating, half-way research. Let us make it, instead, coordinated, comprehensive, and thorough!

As one specific example of the application of this plan, consider the problem of mechanization and motorization. Many agencies within the Army are at work on it—the Air Corps Board, the Tank Board, the Infantry Board, the Artillery Boards, the Ordnance Department, the Quartermaster Corps, and yet other branches and services—each more or less isolated and working under restrictions and handicaps. How much faster, how much more satisfactory, and how much more economical would be the progress if this effort were being made by one adequate and suitable organization!

To what extent have we been engaging in tactical research? The Service schools are, in general, busy teaching existing doctrines. They do not develop new doctrines and teach them. That is not their purpose. It would be inappropriate for them to do so, for conflict and confusion would be the probable results. The branch boards jot down their ideas and observations to the best of their ability—each along its own restricted lines, however. It falls to the War Department General Staff to effect coordination. But not even the best will and the greatest ability make it possible for officers, while at desks, to visualize completely and determine properly matters that should be determined by investigation, conference, experimentation, development, test, and more conference. Certainly our tactical research is not very thorough or coordinated. Surely tactics is in need of the coordinated research!

But how would such a new organization fit in with the General Staff? The answer appears to be, "Most favorably."

Let us first consider the War Plans Division. It prepares certain necessary plans. These plans, in numerous particulars, create the need for studies of details and for adaptations and modifications in organization and equipment. The new agency would do this work and thus supplement the work of the War Plans Division.

Let us now consider the four numbered divisions of the General Staff. They do work of a more characteristically general staff nature. Would the new agency take away from the General Staff some of its normal and logical duties? It would not. The chief purpose of the General Staff is to assist the commander in arriving at decisions, in forming plans, and in supervising administration, troops, and special agencies. No, the innovation would not interfere with the responsibilities of any division, or with the work of the General Staff as a whole. It would, of course, be the duty of the General Staff to examine the reports and recommendations of the proposed agency preliminary to executive action thereon by the War Department.

The citizens of our country do not favor a large army in time of peace, but they have often expressed their desire that their small army be highly developed and highly efficient. Let us not fail to heed that mandate! If we are not to fail, we must keep up-to-date. Our research and development must keep up the proper pace. But a spade and a rake are poor substitutes for a plow. Probably about one per cent of our money, brains, and man power is being devoted to research and experimentation. The ninety-nine per cent goes for plans, training, routine duties, supplies, and other activities of the Regular Army, the National Guard, and the Organized Reserves. It would appear that the rights of our citizenry and the best interests of national defense demand a revision of the ratios—a better effort in the field of research, experimentation, and development. This field of effort should be an outstanding element in the justification for our peace-time Army. It is an important, it not a vital, phase of our preparedness.

It is amazing to discover how little our citizens understand of this dramatic history of purely civic accomplishment. It is equally amazing to most of them when they do learn the facts. . . . After the San Francisco earthquake and fire in 1906, it was the Army that took charge of disorder and administered the forces of order. In the Galveston disaster of 1915 the Army made a record for heroic achievement. Similarly the constructive value of the War Department was felt in the Mount Pelee disaster and during the Ohio and Mississippi floods of 1912. There is a huge file of grateful letters received by the Department for its work in these instances and other similar.—Secretary of War, John W. Weeks.

EDITORIAL

Mechanization and Motorization

ON another page the JOURNAL presents an article on mechanization, wherein it is pointed out that the development of large, fast tanks has reached a point which calls for a marked revision of battlefield tactics. To illustrate his point, the author assumes a situation in which one side alone is equipped with such tanks, and in which neither side is possessed of modern light one-man or two-man tanks. Given such a situation, one side will be at a disadvantage which no revision of tactics can ever remedy. But will that be the normal situation?

All the powers are interested in mechanization, and England, France, and the United States, in particular, are making rapid progress. Accompanying mechanization in these countries is the subject of motorization. Armored cars, fast trucks for transporting cavalry, infantry, and cargo, heavy tanks, light tanks, self-propelled artillery, television, transmission of pictures by wire, and radio all go hand in hand to influence the battle of the future. All are not equally developed, but all are past the purely experimental stage. Armored cars were developed early in the World War and are entirely practicable. The high-speed truck and the fast tank are with us. It is understood that England has not found the one-man tank efficient as a fighting machine, but two-men tanks are but slightly larger and no slower. Television is new, but wire transmission of photographs is practicable. Not long ago a photograph taken from an airplane at Fort Leavenworth was delivered at Governor's Island within thirty minutes or some such ridiculously low time.

Can we not therefore visualize war of the future as an extremely high-speed and extremely mechanical affair? Advance reconnaissance work is carried out by airplanes and armored cars. Cavalry, transported by fast trucks, go where required for local reconnaissance to supplement the armored car. Infantry, moving more slowly, comes up, accompanied by light tanks and artillery which, probably, is armored. Fast trucks comprise the supply columns, to be supplemented later, perhaps, by the vehicles used to carry men, horses, and combat machines. Except in point of protection and of speed, is the situation materially different from that of yesterday? Everybody is better protected, and relative speeds remain unchanged. Cavalry still travels faster than the infantry; the artillery still has difficulty keeping up.

Airplanes and armored cars meet like weapons and one side or the other is forced in; both sides learn information of the other, one side more fully than the other; both sides deploy and endeavor to secure the advantage of position; tank meets tank, and both sides are subjected to artillery fire.

With the introduction of these new instruments of war, will not all of the principles and most of the major details of our present teaching remain almost

wholly unchanged? Will not the only material modification come in the time and space factors? We shall have to think faster and act faster; we shall require better and more rapid communication; our perspective must be larger; but otherwise, we can apply what we have learned in the past.

The large problem will be that of command. The commanding general must see—or visualize—the battlefront and he must have extremely rapid transmission of orders. These questions are not yet solved. Television and radio may furnish the solution, but they are not yet prepared to do so. What time may bring forth, no man may tell, but probabilities and possibilities should be discussed and the JOURNAL pages are open to the opinions of its contributors. Mechanization and motorization are upon us. To what extent will they influence battlefield tactics?

Change of Address

From and after April 1 the editorial and business offices of the COAST ARTILLERY JOURNAL will be located at 1115 Seventeenth Street, N. W., Washington, D. C. After thirty-seven years at Fort Monroe, the JOURNAL leaves that station with reluctance, but business reasons dictate the move. Closer relationship with the other service periodicals, with the office of the Chief of Coast Artillery, and with the Corps seems to have become necessary and to outweigh the advantages of location at Fort Monroe. The JOURNAL trusts that such associations and the greater amount of time and thought which may be devoted to the needs of the Corps will be productive of a better and more interesting periodical. The JOURNAL also trusts that its friends will visit it at its new address whenever they may be in Washington.

There is a phase of military training for our young men, to which attention is especially invited, and that is the benefit to the individual himself. He is taught respect for authority of which there is far too little in our country. He learns self-discipline, hygiene, self-confidence, and has an opportunity to develop qualities of leadership, with an understanding of its responsibilities.—General John J. Pershing.

PROFESSIONAL NOTES

Coat of Arms of the Harbor Defenses of Balboa

Shield: Gules, a chevron *or* semme of hearts of the first between in chief two portcullis of the second and in base an old fashioned cannon paleways of the like garlanded with Santo Espirito orchids proper.

Crest: On a wreath of the colors a dexter arm embowed tatooed on forearm with skull and bones and anchor with blue sleeve rolled up holding a smoking 17th century pistol, all proper.

Motto: Strength, Loyalty, Valor.

The shield is red, the artillery color, and with the gold charges gives the Spanish colors. The name of the first President of Panama and of the principal fort of the defenses, Amador, is indicated by "Canting heraldry" by the red hearts strewn on the yellow chevron. The Coast Artillery is shown by the single heavy gun and the jungle by the twisted garland of Holy Ghost orchids which are said to grow only on the Isthmus. The Isthmus formed the gateway through which poured the treasure of Peru to old Spain, later the wealth of California to the east, and now the commerce of the Atlantic to the Pacific. This gateway is represented heraldically by the portcullis and since the Pacific side has two locks two are used.

The crest recalls the early stormy days on the Isthmus culminating in the sack of old Panama by Sir Henry Morgan. The drawing is from an actual weapon of the period and place.

Modification of 155-MM Rammer

By LIEUT. J. E. REIERSON, C. A. C.

1. The modification of the rammer for the 155-mm. gun as described herein requires an alteration of materiel.

2. Modification:

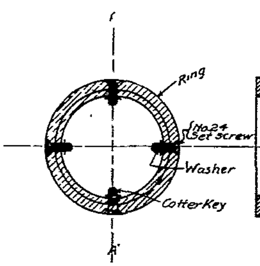


Fig. 2

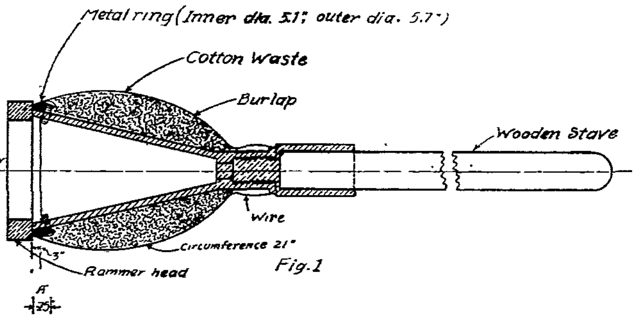


Fig. 1

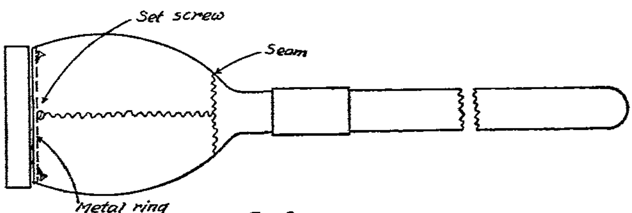


Fig. 3

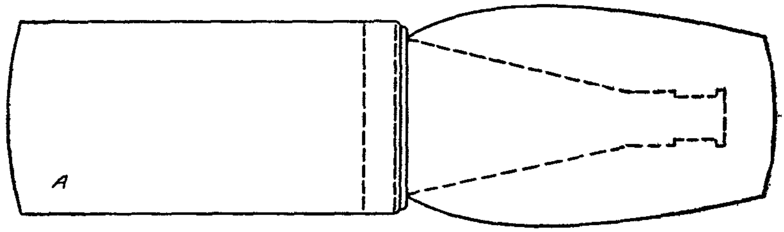


Fig. 4

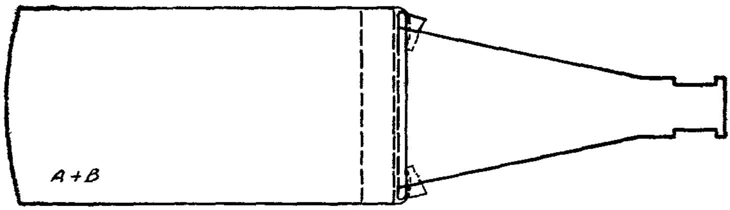


Fig. 5

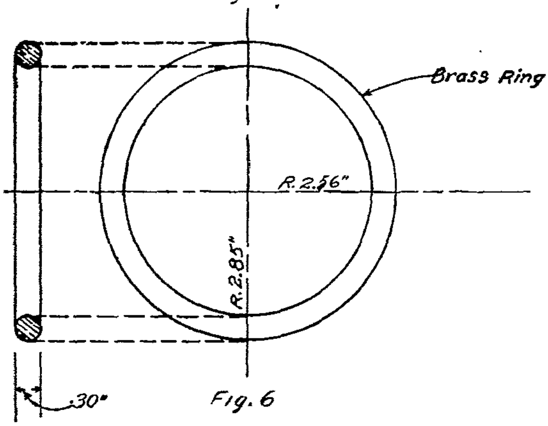


Fig. 6

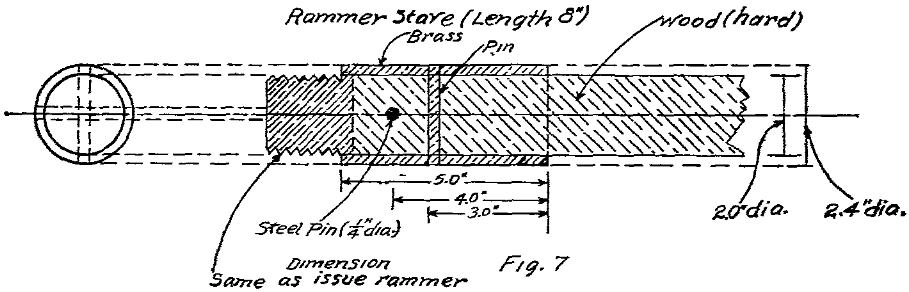


Fig. 7

a. Four holes (equally spaced) are drilled and tapped through the rammer head to receive No. 24 brass flat-head screws.

b. These set screws support a metal (preferably brass) ring through which a double thickness of burlap, 24″x 23″, is threaded the long edge parallel to the stave and its mid point approximately ¾ inch in rear of the rim of the rammer head. That half of the burlap (B) in rear of the rammer head is now folded over the rammer head (see figure 4).

3. The ring is now pushed against the rim of the rammer head and the set screws screwed home (figure 5). The ring will now hold the front end of the sponge. The burlap (A and B) is now folded back over the rammer.

4. Cotton waste is now packed inside the burlap and around the rammer. When the sponge is well packed and has a maximum circumference of 21 inches, the seam (parallel to the stave) is sewed.

5. The open end is now wired to the rear of the rammer head. Any burlap in rear of the turns of wire is folded back over the wire and sewed to the rear end of the sponge.

6. The iron stave is replaced with a wooden stave for ease in handling (figure 7).

7. The advantages of this rammer-sponge are:

a. A rammer similar to the above was made by the writer and used by Battery B, 92nd Coast Artillery (PS), in all practices this year and saved on an average of 3 seconds per salvo.

b. The ramming and sponging were as good as if the separate units were used. This was accomplished by using three men on the rammer-sponge. A test made in one practice showed the density of loading to be equal for each trial shot.

c. This rammer-sponge is easier to handle than the rammer as issued, as it weighs 13 pounds less after being dipped in water.

d. It has the advantage over any other rammer-sponge the writer has seen in that it will, with proper care, last at least an entire season. The wear and tear is taken up by the front of the rammer head.

e. It will cost little to modify.

Ballistic Effects Due to the Rotation of the Earth

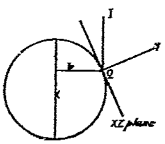
By Henry B. Hedrick, Ph. D.

The transfer of the rotation of the earth to a parallel axis passing through the point O, occupied by the gun, is accomplished by reducing the point O to rest by applying to every point under consideration an acceleration equal and opposite to that of O, namely $\Omega^2 b$ where b is the distance of the point O from the axis of rotation, and also applying a velocity equal and opposite to the initial velocity of O, namely Ωb. The whole figure will then be turning about an axis OI, parallel to the axis of rotation of the earth, with an angular velocity Ω. It is this latter rotation which was resolved by the present writer into the three components Ω_x, Ω_y, Ω_z, on page X of the introduction to the 1924 Ballistic Tables, namely;

(1) $\Omega_x = \Omega \cos L \cos A$

$\Omega_y = \Omega \sin L$

$\Omega \;\; = \Omega \cos L \sin A$



where

A = Azimuth of the plane of fire

L = Latitude of the position of the gun

Ω_X= Rotation about the X-axis
Ω_Y= Rotation about the Y-axis
Ω_Z= Rotation about the Z-axis

The term in acceleration, $\Omega^2 b$, is included in the value of g used, thus in meters

$g = 9.8060\text{-}0.0260 \cos 2L$ (Helmert)

The rotation of the earth on its axis is a simple physical fact and the mathematical formulae for its effect on the flight of a projectile may be developed as follows:

Let u, v, w, be the component velocities in space of a particle whose rectangular co-ordinates are x, y, z with origin at the gun. The resolved velocities relatively to the moving axes are x′, y′, z′. To find the motion in space we must add to these the resolved velocities due to the motion of the axes. If we suppose the particle to be rigidly connected with the axes, its velocities would be expressed by $-z\,\Omega_Y + y\,\Omega_Z$, $-x\,\Omega_Z + z\,\Omega_X$, $-y\,\Omega_X + x\,\Omega_Y$. By adding the parts together the actual resolved velocities of the particle will be

(2) $u = x' - z\,\Omega_Y + y\,\Omega_Z, v = y' - x\,\Omega_Z + z\,\Omega_X, w = z' - y\,\Omega_X + x\,\Omega_Y$

Since acceleration is the rate of increase of velocity just as velocity is the rate of increase of space, it is clear that the relations which hold between accelerations and velocities must be the same as those which hold between velocities and spaces. Thus the relations between the accelerations, X, Y, Z, and u, v, w, follow at once from those between u, v, w, and x, y, z, hence:

(3) $X = u' - w\,\Omega_Y + v\,\Omega_Z, Y = v' - u\,\Omega_Z + w\,\Omega_X, Z = w' - v\,\Omega_X + u\,\Omega_Y$

From (2) by differentiation we obtain,

(4) $u' = x'' - z'\,\Omega_Y + y'\,\Omega_Z, v' = y'' - x'\,\Omega_Z + z'\,\Omega_X, w' = z'' - y'\,\Omega_X + x'\,\Omega_Y$

whence (3) becomes

$$
\begin{aligned}
X &= x'' - 2z'\,\Omega_Y + 2y'\,\Omega_Z + \text{terms containing } \Omega^2 \\
(5)\quad Y &= y'' - 2x'\,\Omega_Z + 2z'\,\Omega_X + \text{terms containing } \Omega^2 \\
Z &= z'' - 2y'\,\Omega_X + 2x'\,\Omega_Y + \text{terms containing } \Omega^2
\end{aligned}
$$

Without rotating $u = x'$, $v = y'$, $w = z'$

(6) and $X = u' = x''$, $Y = v' = y''$, $Z = w' = z''$

From (5) and (6) and substituting the values of Ω_X, Ω_Y, Ω_Z, from (1), given above, the effect of rotation of the earth may be written:

$$
\begin{aligned}
\delta x'' &= -\,2\,y'\,\Omega \cos L \sin A + \text{term in } z' \\
\delta y'' &= +\,2\,x'\,\Omega \cos L \sin A - \text{term in } z' \\
\delta z'' &= +\,2\,y'\,\Omega \cos L \cos A - 2x'\,\Omega \sin L.
\end{aligned}
$$

The Irish Free State Army

It is announced that the Government of the Irish Free State, intent on economy, proposes to make a big reduction in the strength of the Free State Army. The last Army Estimates amounted to £1,800,000. This year there is to be a cut of £300,000. The Army has an active strength at the present time of 736 officers and 7,919 other ranks. During the present year it is to be reduced to a total strength of 5,000. There will be a Class "A" Reserve for those who have served in the Regular Army, and a Class "B" Reserve for those who have had no military service. In addition, there will be a Volunteer Force on the lines of the British Territorial Army. Those enrolled in this force will drill weekly in their own areas, and will be called out for annual training. Among the additions to the equipment of the Army is a tank of Japanese design—which is odd. Special inducements are

offered to officers who are prepared to resign. Those who have served continuously since October 1, 1924, will receive a gratuity calculated on the cash value of the pay and allowances of the rank held (acting or substantive) at the date of the acceptance of the resignation. They will thus be given: (a) Two years' full pay of the rank held at the date of resignation; (b) two years' ration allowance at the rate in force for single officers, and (c) two years' lodging, fuel and light allowance. In the case of a married officer the amount shall be assessed at the rate applicable to married officers. Officers commissioned later than 1924 will receive 61 days' pay at the rate of the rank held on retirement, 61 days' ration allowance and 61 days' lodging, fuel and light allowance. Officers on half-pay are entitled to the gratuities on the same scale as officers on full pay. Officers who retire will be transferred to the Reserve (Class "A"), and officers who resign will sever all connection with the Free State Army.—*The Army, Navy and Air Force Gazette.*

Target Glider Experiments at Wright Field

By A. M. JACOBS

Captain Carl Greene recently acted as observer for Major Gerald E. Brower in a series of flight tests with the target glider and came down declaring that he wouldn't be surprised if Major Brower soon had the thing so docile as to be able to land it at any given point on the speed course from any altitude. The inspiration for such extravagance was the three flights he had just witnessed in which the glider after release had behaved exactly as the Major had foreordained.

The target glider, it will be remembered, is a twelve-foot high-wing monoplane of box-spar construction, carried on the upper wing of a full-sized air plane from which it is released, becoming as it floats out into the air, a target for aerial gunnery or antiaircraft practice. By bending the elevator and tab to certain settings, various angles of descent may be predetermined.

On the aforementioned flight, Major Brower had made the setting for smooth steady flight, and a smooth steady flight had followed until it drifted gently to earth. Next he set it for diving and zooming for 2000 feet from a 3000 foot altitude. It obeyed. But the third demonstration was the one which took Captain Greene's breath. In order to make the glider suitable for naval antiaircraft practice, Major Brower had padded it with kapok to keep it afloat. He made the setting for a stall and a dive from 800 feet. Flying at this altitude, he and Captain Greene proceeded to a small lake about 300 yards wide, situated near Wright Field. At the proper moment he released the glider, which with three oscillations landed squarely in the middle of the water. The floatation feature was successful, as it was still atop when several hours later they went to haul it out.

This glider has proved quite durable, having made more than fifty landings without damage. Major Brower is now developing a metal wing to replace the present wood structure. It is believed this will better retain rigidity than the present type, which becomes "floppy" after numerous landings and cannot be set quite so accurately.—*Air Corps News Letter.*

COAST ARTILLERY BOARD NOTES

Communications relating to the development or improvement in methods or materiel for the Coast Artillery will be welcome from any member of the Corps or of the service at large. These communications, with models or drawings of devices proposed, may be sent direct to the Coast Artillery Board, Fort Monroe, Virginia, and will receive careful consideration. W. E. Cole, *Colonel, Coast Artillery Corps, President, Coast Artillery Board.*

Project No. 678, Test of Sponge-Rammers, T-3, for 155-mm. Gun.—Four Sponge-Rammers for the 155-mm. gun have been manufactured by the Ordnance Department and shipped to Fort Eustis for service test under the supervision of the Coast Artillery Board.

Project No. 679, Ramming Test of Dummy Projectiles, 12" Gun.—A rear band assembly for 12" dummy projectile, manufactured by the Ordnance Department, and designed to eliminate sticking of dummy projectile, is being shipped to Fort Monroe. This assembly has been given a test at Fort Hancock, but before standardizing the design, a further test of at least 100 ramming will be conducting under the supervision of the Coast Artillery Board.

Project No. 680, Experimental Antiaircraft Observation Device.—This instrument was developed at Fort H. G. Wright and later tested at Aberdeen Proving Ground in connection with the firings and tests of the 62d Coast Artillery. The Coast Artillery Board has made a study of this device in comparison with the Camera Spotting Unit.

Project No. 681, Test of Fast Towing Target (Navy Design).—This target, constructed by the Navy Department, is designed to be towed by a destroyer at a speed of 25 to 30 knots. Preliminary towing tests are scheduled for the month of February.

Project No. 682, Firing Lanyard for 3" Antiaircraft Gun, M1917.—Firing lanyards similar to those at present employed on the 3" A. A. Gun M1917 MI are recommended for installation on the 3" A. A. Gun M1917. As fuze setters are to be installed on the left hand side of the gun, the piece will be fired from the right hand side, and a guide will be placed near the breech to permit this being done.

Project No. 683, Replacement of Standard Motor Vehicles by Commercial Types.—Increased demands for motor vehicles as replacement require a careful study to determine the most logical types of commercial vehicles to be used and special kinds which must be developed. The Coast Artillery Board is making a study of the special vehicles required for the Coast Artillery Corps.

Project No. 684, Marine Smoke Bombs and Float Boxes.—The question has been brought up several times as to whether or not any military requirement existed for marine smoke bombs and float boxes which were developed during the War for use by the Navy. The Coast Artillery Board has this question under study.

Project No. 685, Employment of Star Shells for Antiaircraft Firing.—The possibility of employing one of the four guns of an antiaircraft gun battery to fire star shells for the purpose of illuminating the target sufficiently to allow the fire control section to pick up same and fire upon it with the other guns of the battery has been suggested. Development of the idea has been recommended.

Project No. 686, Test of Flashlights.—Four flashlights of various types have been sent to the Coast Artillery Board for test with a view to determining whether or not one of them can be regarded as satisfactory for adoption as standard for issue to the Coast Artillery in place of the present Signal Corps type TL-95 flashlight, and such other miscellaneous flashlights as are now in the hands of troops. The flashlight shave been turned over to the 52d Coast Artillery (Ry) for service test.

A TABULATION OF CHARTS AND SCALES FOR EXISTING SEA COAST ARMAMENT.

These charts and scales are prepared by the Coast Artillery Board under the direction of the Chief of Coast Artillery, for issue to the service.

				Range Cor. Boards	*Deflection Boards*					*Percentage Corrector*						*Inter-polator Scales*			
					Charts			*Scale Az. C. A. B. Univ.*		*Range-Range Relation Scales*									
Caliber	*Model*	*Projectile, Weight, Lbs.*	*Muzzle Velocity, F. S.*	*Percentage Range Correction Charts*	*Mortar, Model 1906*	*C. A. B. Universal*	*T2 Stephens*	*Degrees*	*Mils*	*Standard*	*Non-Standard*	*Non-Standard*	*Range Scales, Yards*	*Range Ele. Scales, Deg.*	*Range Ele. Scales, Mils.*	*Range Scales, Yards*	*Elevation Scales, Deg.*	*Elevation Scales, Mils*	*Elevation Tables*
37-mm	Sub-Caliber for 155-mm Gun	1.097	1312	R	NR	R	R	NR	R	NR	NR	NR	NR	NR	R	NR	NR	R	NR
1.457	Sub-Cal. for 6″-8″-10″-12″-14″ Guns	1.1	2000	R	NR	R	R	R	NR	NR	NR	NR	R	NR	NR	R	NR	NR	R
75-mm	Sub-Caliber for 12″ Mortars	18.0	Zone	R	R	R	R	R	NR	NR	NR	NR	NR	R	NR	NR	R	NR	NR
75-mm	Ex-Cal. for 14″ RR-16″ and 16″ How	15.96	1693	R	NR	R	R	R	NR	NR	NR	NR	NR	R	NR	R	R	NR	*
6″	1897MI, 1908, 1908MI, 1908MII	108	2600	R	NR	R	R	R	NR	108	90	NR	R	NR	NR	R	NR	NR	R
6″	1897MI, 1908, 1908MI, 1908MII	90	2700	R	NR	R	R	R	NR	90	108	NR	R	NR	NR	R	NR	NR	R
6″	1900, 1903, 1905	90	2600	R	NR	R	R	R	NR	90	108	NR	R	NR	NR	R	NR	NR	R
6″	1900, 1903, 1905	90	1950	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
155-mm	1918, Filloux	95	1955	R	NR	R	R	NR	R	NR	NR	NR	NR	NR	R	NR	NR	R	NR
155-mm	1918, Filloux	95	2410	R	NR	R	R	NR	R	NR	NR	NR	NR	NR	R	NR	NR	R	NR
8″	1888, 1888MI, 1888MII	200	1950	R	NR	R	R	R	NR	200	323	NR	R	R	NR	R	R	NR	R
8″	1888, 1888MI, 1888MII	200	2600	R	NR	R	R	R	NR	200	323	NR	R	R	NR	R	R	NR	R
8″	1888, 1888MI, 1888MII	323	2200	R	NR	R	R	R	NR	324	200	NR	R	R	NR	R	R	NR	R
10″	1888, 1888MI, 1888MII, 1895	510	1800	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
10″	1888, 1888MI, 1888MII, 1895	510	2400	R	NR	R	R	R	NR	510	617	NR	R	NR	NR	R	NR	NR	R
10″	1888, 1888MI, 1888MII, 1895	617	2250	R	NR	R	R	R	NR	617	510	NR	R	NR	NR	R	NR	NR	R
240-mm	Howitzer, (Schneider) 1918MI	345	Zone	R	*	*	*	*	*	NR	NR	NR	*	R	*	*	*	*	NR
12″	1895, 1895 MI	900	2325	R	NR	R	R	R	NR	900*	975*	1070*	R	NR	NR	R	NR	NR	R
12″	1895	975	2275	R	NR	R	R	R	NR	975	900	1070*	R	NR	NR	R	NR	NR	R
12″	1895	1070	2250	R	NR	R	R	R	NR	1070	975	900*	R	NR	NR	R	NR	NR	R
12″ M	1890, 1890MI, 1908, 1912. (Using Aliquot part charges)	700 824 1046	Zone	R	R	R	R	R	NR	NR	NR	NR	NR	R	NR	NR	R	NR	NR
12″ M	1890, 1890MI, 1908, 1912. (Using Base Increment charges)	700 824 1046	Zone	R	R	R	R	R	NR	NR	NR	NR	NR	R	NR	NR	R	NR	NR
14″	1907, 1907MI	1400	2200	R	NR	R	R	R	NR	1400*	1560*	1660*	R	NR	NR	R	NR	NR	R
14″	1909, 1910, 1910MI	1400	2400	R	NR	R	R	R	NR	1400	1560*	1660	R	NR	NR	R	NR	NR	R
14″	1920 MII	1400	2700	R	NR	R	R	R	NR	NR	NR	NR	R	R	NR	R	R	NR	R
14″	1907, 1907 MI	1560	2170	R	NR	R	R	R	NR	1560	1400	1660	R	NR	NR	R	NR	NR	R
14″	1909, 1910, 1910MI	1560	2370	R	NR	R	R	R	NR	1560	1400	1660	R	NR	NR	R	NR	NR	R
14″	1907, 1907 MI	1660	2150	R	NR	R	R	R	NR	1660	1400	1560	R	NR	NR	R	NR	NR	R
14″	1909, 1910, 1910 MI	1660	2250	R	NR	R	R	R	NR	1660	1400*	1560*	R	NR	NR	R	NR	NR	R
14″	1909, 1910, 1910 MI	1660	2350	R	NR	R	R	R	NR	1660	1400	1560	R	NR	NR	R	NR	NR	R
16″	1919, 1919MI, 1919MII	2100	2210	R	NR	R	R	R	NR	NR	NR	NR	R	NR	NR	R	NR	NR	R
		2100	2470	R	NR	R	R	R	NR	NR	NR	NR	R	NR	NR	R	NR	NR	R
		2100	2750	R	NR	R	R	R	NR	NR	NR	NR	R	NR	NR	R	NR	NR	R
16″	1919, 1919MI, 1919MII	2340	2190	R	NR	R	R	R	NR	NR	NR	NR	R	NR	NR	R	NR	NR	R
		2340	2440	R	NR	R	R	R	NR	NR	NR	NR	R	NR	NR	R	NR	NR	R
		2340	2700	R	NR	R	R	R	NR	NR	NR	NR	R	NR	NR	R	NR	NR	R
16″	1920	2100	1350	R	NR	R	R	R	NR	NR	NR	NR	NR	R	NR	NR	R	NR	NR
How.		2100	1550	R	NR	R	R	R	NR	NR	NR	NR	NR	R	NR	NR	R	NR	NR
		2100	1750	R	NR	R	R	R	NR	NR	NR	NR	NR	R	NR	NR	R	NR	NR
		2100	1950	R	NR	R	R	R	NR	NR	NR	NR	NR	R	NR	NR	R	NR	NR

LEGEND:

R—Ordinarily required and now ready for distribution.

NR—Not ordinarily required but may be supplied if necessary.

*—Not prepared at this time.

The Coast Artillery Board Table,
Fort Monroe, Va.
Jan. 26, 1929

BOOK REVIEWS

The Fundamentals of Military Strategy. By Oliver Prescott Robinson, Lieutenant Colonel, Infantry. Washington: United States Infantry Association. 1928. 5¾"x 8¼". 232 pp. $3.00.

Strategy. By George J. Meyers, Captain, U. S. Navy. Washington: Byron S. Adams. 1928. 5¼"x 7¾". 263 pp. $3.00.

Here are two books on the same subject written one for the Army and one for the Navy. Fundamentally, the principles of strategy are the same on water as on land. The application may differ, the conditions under which the application is made may not be the same, but sound naval strategy is sound military strategy. Either book may therefore be used by either service.

While both books teach much the same doctrine and quote the same authorities, they differ in their method of attack. Captain Meyer handles the subject from the broader viewpoint and omits, in general, discussion of matter which is generally to be found in accepted authorities. Colonel Robinson, seeking to point out fundamentals, discusses strategy more in detail and makes free use of examples. He takes up each of the principles of war in turn, although he prefers to refer to them as ideas, rather than principles, pointing out that doubt may arise as to whether some of them are in truth principles but that there can be no question of them as ideas.

Colonel Robinson's book will have the greater value for the novice in the realm of strategy, and it is accompanied by an extensive bibliographical list which, although not classified, will be very convenient for the military student. Captain Meyers' book will find merit in the eyes of those who are already somewhat familiar with fundamentals. It supplements the more elementary book, and it has a valuable section of suggested reading courses, classified as to subject and subdivided to show particular chapters or pages of the authorities quoted.

Both works are recommended for the military student.

Andrew Jackson: An Epic in Homespun. By Gerald W. Johnson. New York: Minton, Balch and Company. 1927. 6"x 8". 303 p. Il. $3.50.

With the exception of Abraham Lincoln, probably no man who has risen to a high place in American public life owes less to the element of chance or luck than does Andrew Jackson. Born on the wild frontier of an infant nation and reared among the educational disadvantages of the frontier, he rose to power and created for himself a place in history through sheer force of character backed by tremendous natural ability. Direct, determined, forceful, and hypersensitive, handicapped much of the time by ill health, he led a theatrical life in which he generally held the center of the stage. District attorney, Representative in Congress, Senator, Justice of the State Supreme Court, Major General of militia, and Major General in the Regular Army, he seemed unable to escape from a public career. He had early attracted a large following among the public, but his success over Packenham at New Orleans made him a national idol. It being a custom among Americans to reward their popular heroes with public office, the Battle of New Orleans assured Jackson the Presidency.

Although General Jackson can not be ranked great among generals, the military man can find much of benefit in a study of his career. His methods were even more direct

than those of General Grant and had more of personal leadership in them. Mr. Johnson makes no comparisons, but he makes it clear that General Jackson was not instinctively a military leader, as were many of those who rose to fame in the Civil War. He was, however, a born leader of men and he applied the rules of common sense to the problems that confronted him. For this reason he was eminently successful whenever the matter of leadership was involved.

In his book, Mr. Johnson writes sympathetically—perhaps too much so. Jackson was a man of the people, possessed of many faults and many weaknesses. This the author admits but, while attempting no excuses, he argues that it was these very weaknesses that made Jackson great. There being no subtlety in the General's character, he did what he pleased when he pleased, without apology or equivocation, whether it was cock fighting or the establishment of the Spoils System, betting on horse races or the destruction of the National Bank. This, the author points out, the people could understand, and what they could understand they could love. Because Mr. Coolidge is an enigma to them, the people delight in him; because Andrew Jackson had no secrets for them, the people loved him.

Jackson was a great man in a day of great men, and Mr. Johnson's book is worthy of its subject. The narrative is entertaining, the story is nicely proportioned, and the historical background is well sketched in, without being voluminous. This volume earns a place among the best of recent biographical work.

Basic Coast Artillery. Edited by P. S. Bond, J. B. Sweet, and R. Arthur. Annapolis: The National Service Publishing Company. 1928. 6"x 9". 751 p. Il. $3.75.

Advanced Coast Artillery. Edited by R. Arthur and P. S. Bond. Annapolis: The National Service Publishing Company. 1928. 6"x 9". 926 p. $5.00.

Professors of Military Science and Tactics and their assistants have ever been confronted with the difficulties attending the assembly of the necessary instructional texts for the respective R. O. T. C. courses. The lay-out of courses has naturally had its foundation in the instruction necessary to insure the attainment of the required objective, culminating in the basic qualification of the student for commission as second lieutenant in the arm of his choice. A well established standard has always existed as to the required basic qualifications and as to the subjects to be covered as essential to such qualifications, but the instructional texts covering these subjects in a form convenient and complete has been lacking. The assembly of required texts has involved demands on all arms and branches, and in some cases necessitated resort to private purchase of texts not available for issue. Of the great amount of material so selected only a part would be germane to a particular subject of instruction—in some cases a very small part—but the whole must of necessity be accumulated.

The Government has not yet seen fit to remedy this condition, but the enterprise of individuals has stepped into the breach and has provided two text books covering the entire range of subjects of instruction for Basic and Advanced R. O. T. C. Coast Artillery. Since individual enterprise must ever receive its recompense, the cost of these books to student or instructor will serve as an impressive reminder of the great convenience and benefit which will proceed from their possession. It is doubtful, however, that any argument can justify conclusion that the effort required to assemble the similar material from its multifarious sources is not worth $8.75. If another consideration is essential to decision, it is provided in the fact that the material of the two volumes is more complete within the field of the requirements than the similar source material could possibly be. Here is the selected instructional matter which is necessary, largely removed from irrelevant, incidental matter of the same family, and reduced, generally, to the essence of the subject.

The two volumes are complete within their field and accomplish with considerable initial success their purpose in providing only the text material necessary for the required

instruction. That part of the Basic volume covering infantry subjects is especially noteworthy. It covers 424 pages, and is replete with line drawings illustrating movements, postures, proceedures, and methods. The illustrations are carefully prepared and will justify the pains necessary in their preparation in providing visible standards of instruction. The basic material of this entire section is, of course, found in Training Regulations, or other official publications, but it has been amplified and enlarged so commendably that one peruses the text with pleasing interest.

The Basic Coast Artillery Section of the Basic volume is included in 327 pages of text and figures and covers all subjects prescribed for the Basic course. The sources of the material are official publications either of the War Department or of the C. A. School. While this part of the book contains illustrations in ample number of materiel and apparatus, it lacks the wealth of instructional illustration found in the first part. For example, in the sections on service of the piece of the 155-mm. gun and the 3-inch A. A. gun, there are no pictures to illustrate or show the positions, routes, movements, or other duties of cannoneers at any time. The absence of illustrations showing the prescribed standard practices leaves to each individual instructor the necessity for interpreting the written text according to his own light.

The subject matter in this second section is rightfully condensed. It is required that essentials only be given. In an apparent effort to cover the entire field, however briefly, certain material has been included which had better been left out. In the chapter on Telephones there is a paragraph titled "Tactical Employment of Wire Systems." As a subject, this is not pertinent to the instruction of the student in basic coast artillery subjects. It is, in fact, a most advanced and involved subject, and when the text book presumes to cover such a subject in 40 printed lines, the effect is somewhat absurd. The matter which is actually presented under the paragraph heading has to do with general principles underlying the establishment of wire systems, and some random general signal communications doctrine. For example: "a supporting unit is responsible for wire communication from its command post to the command post of the supported unit." It would appear better to have left out all such matter.

The subsequent six paragraphs are in the same category. They list signal agencies and telephone communications pertaining to the artillery brigade, regiment, battalion, battery, AA Sector (which has no official recognition as a tactical element), and AA Battery. The matter presented is of no instructional value by itself, it has no part in basic coast artillery instruction, and had best be omitted.

While the strength of this section of the book would be increased by the elimination of such highly condensed (and extraneous) material, it is not to be inferred that the criticisms offered are major objections. In fact the matter cited is included in about three pages. The general worth of the Coast Artillery Section, as of the Infantry Section, is great. No necessary material is lacking, and it represents standard practices at the time of publication of the book. Improvements of both subject material and the manner of its presentation may be made in subsequent editions. But this may be said of any text book.

The second volume, Advanced Coast Artillery, covers the range of subjects required in the advanced R. O. T. C. courses. As to material it is generally satisfactory; as to arrangement of material it shows some signs of haste in its assembly. One subject follows another without, in some cases, any logical connection or sequence. This may not be an objection, but there are some who will believe that it is in any event a cause for criticism. Military Sketching; Military Law; Rules of Land Warfare; Officers Reserve Corps Regulations; Military History of the U. S.; and Company Administartion follow in order hard on the heels of each other. The essential point, however, is that the essential material which is required is presented in the single volume, and this is much of a recommendation.

It is inevitable that, in the preparation of such works as these, some material must be included which is standard practice only for the time being, which is obsolescent or in the process of becoming so, or which is of such a nature that it is likely to be superseded

at an early date by new developments. But the compiler has only human facilities and intelligence which he may apply, and he accomplishes his work as seems best at the moment. It is probable that, while the basic principles will remain, the detailed proceedures in the solution of the AA gunnery problem will undergo marked changes in the immediate future. So also with respect to the fire control system for seacoast artillery. It remains for the publishers to keep these volumes in step with developments by the publication of supplements from time to time to supersede the obsolescent and obsolete matter. To accomplish their mission to the maximum degree they must present latest standard practices, the entire range of prescribed subjects arranged among themselves, in so far as possible, in logical order; each subject complete to the extent demanded only by requirements of the courses, and the whole stripped of all irrevelant, incidental, or non-essential related matter. The volumes do not wholly conform to this standard, but they probably approach it as nearly as any initial edition of such a work might hope to do.—R. B. B.

Lincoln. By Lucy Foster Madison. Philadelphia: The Penn Publishing Company. 1928. 7"x 10¼". 368 p. Il. $3.50.

Lucy Foster Madison has written a very entertaining story which must not be taken too literally. She dramatizes her account. Her characters converse in colloquial American throughout the book. We learn, for example, what Austin Goelaher, aged eight, and Abe Lincoln, aged six, ate for dinner, where they went to play, and what they said. All very interesting and very, very easy to read. If one likes biography sugar coated, here it is.

The author is an ardent admirer of Lincoln and she writes with a fluent and delicate pen. She brings out strongly his best points and passes lightly over or ignores the stories which are not altogether to his credit. In the essentials she adheres entirely to facts, but she devotes altogether too little space to Lincoln's later years. The emphasis is placed upon his youth, and the period of his Presidency receive but thirty-two pages. Surely Mr. Lincoln's years in the White House were worth more than that.

The typography is excellent, with an open type face, well leaded. Eight extremely good illustrations in color by Frank E. Schoonover are inserted in the text, and the cover is an unusual example of the art of book binding. An entertaining, cleverly written book, beautifully turned out.

Emden: The Story of the Famous Cruiser. By Franz Joseph, Prince of Hohenzollern. London: G. H. Watt. 1928. 5½"x 8½". 293 p. Il. $3.00.

A well told tale of the cruise of the *Emden.* The author, a lieutenant on that ship, writes a straight-forward and personally modest account of her famous raid, for the truth of which he says "I engage my hand and heart." And indeed it rings true, with surprisingly little rancor or boasting. He does, however, point out clearly that there was no necessity for the British to have reopened fire on the wreck of the *Emden* some five hours after she had been run aground, thereby increasing the casualties aboard her. Nor is he at any pains to conceal the fact that the British made no attempt to take the survivors off the *Emden* until some 26 hours after she had been grounded. But he does say frankly that Captain von Müller of the *Emden* attempted to blow up the wreck of his ship long after she had surrendered, and apparently at the further peril of his own men as well as of the English rescuing parties.

The cruise of the *Emden* covered 30,000 miles and lasted more than two months. Besides her bold and successful attacks on Madras and Penang she sank many ships, disrupted British shipping in the Indian Ocean, and forced the employment of many much needed warships in her pursuit. Yet she was a small ship, mounting only 4.1-inch guns, and probably inferior in fighting power to all enemy cruisers in that part of the world, with the possible exception of the Jemtchug which she sank at Penang. She also had a very limited cruising radius. So small was coal-carrying capacity that she was forced to travel

in company with slow colliers almost all the time. Not only had she no coaling ports but she appears to have been unable to get coal from neutrals though she did occasionally coal from colliers in Dutch waters.

In the face of her record it is rather remarkable that the British, in their recent discussion with us on cruiser limitation, should have contended that their 7500-ton cruisers (more than double the size of the *Emden*), mounting 6-inch guns (against the *Emden's* 4.1-inch), and with much greater cruising radius, are defensive and not offensive ships.—S. M.

Now It Can Be Told. By Sir Philip Gibbs. Garden City: Garden City Publishing Co., Inc. 5¼"x 8". 558 p. $1.00.

Father Duffy's Story. By Chaplain Francis P. Duffy. Garden City: Garden City Publishing Co., Inc. 5¼"x 8". 382 p. $1.00.

These two books are too well known to require comment. Father Duffy, as Chaplain of the 165th Infantry, and Sir Philip Gibbs, as newspaper correspondent, went wherever they considered their services to be necessary, regardless of danger to themselves, and they saw many things in many places. The correspondent pictures war; people are incidental to the war. The priest pictures soldiers; the war is incidental to people.

Both books proved their worth when they first appeared, and they are now added to the "Star Series" being brought out by the publishers. In the series are included only books that have a lasting interest. These are printed from the original plates and offered at a popular price so as to bring them within the reach of everyone. Unquestionably the stories of Father Duffy and of Sir Philip Gibbs deserve a place in such a series.

Taschenbuch der Kriegsflotten, 1929. By B. Weyer, Korvettenkapitan A. D. Munich: J. F. Lehmanns Verlag. 1929. 4½"x 6¾". 474 p. Il. 15 marks.

This well known little handbook of the navies of the world again makes its annual appearance. It remains much the same as in former years. A section devoted to a tabular arrangement of the vessels of the various countries, arranged alphabetically, gives dimensions, displacement, draft, speed, armor, armament, and engineering and other data for each class of warship. Following this is a section giving photographs, deck plans, elevations, silhouettes, and certain data of all the principal vessels of each navy. The remainder of the volume gives much miscellaneous information, such as naval developments of the past year throughout the world, tables of comparative naval statistics, national flags, signal codes, conversion tables, etc. An alphabetical index makes the book easy to use.

This is a valuable reference work.

National Defense. Compiled by Julia E. Johnson. New York: The H. W. Wilson Company. 1928. 5¼"x 7½". lxxxiii + 469 p. $2.40.

This is a handbook which consists of selected articles on the subject of national defense. The matter included in the book is recent and thus gives the current thought on the subject. In arrangement, there first appear articles in a general discussion of various phases of national defense. This is followed by two sections, in one of which the arguments are *pro* and in the other of which they are *con.* Many phases are discussed and many authors quoted, of whom we may mention Calvin Coolidge, Richard V. Oulahan, Lynn J. Frazier, C. E. Kilbourne, Carrie Chapman Catt, Edwin M. Borchard, Edwin E. Slosson, John W. Weeks, Charles P. Summerall, Curtis D. Wilbur, Dwight F. Davis, Charles Evans Hughes, Kirby Page, John Dewey, Samuel Gompers, and David Starr Jordan. Military aviation constitutes a separate section of the book.

The book, impartial itself, is of real value and will be of service to anyone interested in the present-day discussions on national policy, national defense, and disarmament.

The Magic Island. By W. B. Seabrook. New York: Harcourt, Brace and Company. 1929. 5¾"x 8½". 336 pp. Il. $3.50.

Haiti is a land of mystery which has been attracting the attention of authors in recent months. Whatever be the phase under investigation, it is natural to attach the word *black* to it. Happily, Mr. Seabrook avoids the obvious and strikes upon a more fortuitous title, one which is fully descriptive of his encounters as any he might have chosen. He found magic in the scenery, in the climate, in the romance, and in the mystery of the island, and he found magic in its stark, ugly realism.

To us, accustomed to the American negro, the terms Voodooism and magic are nearly synonymous. In Haiti, though, so the author found after living for months with and among natives of all classes, the two are not necessarily related. Voodooism he found to be a living religion, into the mysteries of which he was initiated. Sorcery, witchcraft, and black magic he also found, and these subjects take up a considerable part of the volume.

The author includes in his account little which he did not experience himself or hear at first hand. We are therefore left with a feeling that the account is not complete. The first part of the book deals with the Voodoo rites, but we are not certain that he has pictured for us the religion as a whole. The second part takes up black sorcery, but here again we get scarcely more than a glimpse of Haitian magic and the part it plays in Haitian existence. The remaining parts of the volume cover more or less unrelated experiences in Haitian socity and in expeditions about the island—cock fighting, the *danse Congo*, mountain climbing, etc.

The book is interesting—exceedingly so. Whether one is interested in Haiti or not, one will find absorbing everything that Mr. Seabrook has to say—our only criticism being that he did not say enough. The bizarre surroundings, the wierd rites, and the queer beliefs have no counterpart in our country, for our own negroes, emotional and superstitious though they may be, have been so long in contact with white civilization that they have long since forgotten the blood-drinking flesh-eating rituals of their African ancestors. Not the least interesting part of the book are twenty gargoylesque drawings by Alexander King and more than two dozen photographs by the author.

The book will not be easily forgotten, and it is likely to be found for some time among the best sellers.

Great Short Biographies of the World. A Collection of Short Biographies, Literary Portraits, and Memoirs Chosen From the Literatures of the Ancient and Modern World. By Barrett H. Clark. New York: Robert M. McBride and Company. 1928. 6"x 9⅛". 1407 pp. $5.00.

Every once in a while someone has a really good idea, and this is one of them. Strictly speaking, it is a development from another idea, not so valuable, for Mr. Clark has previously prepared collections of great short stories and of great short novels. Biography is of particular interest to the reading public these days and anthologies are appearing with increasing frequency, so it is but natural for the two to be associated. Had Mr. Clark not done so, someone else probably would—and another might not have been so discriminating nor made his book so comprehensive.

It is not easy to find short biographies that are really good. Mr. Clark says: "The ideal biography is a well-written story of a person's life, complete, true, and made by someone who knew him intimately. It contains everything that serves to throw light upon his character, his mind, his person, his work. It is written with passion, affection, imagination, understanding, yet without bias or personal prejudice. This is the sort of biography I have sought, but I have yet to find one that fulfilled all my requirements." Nevertheless, he found forty-nine biographies worthy of a place in his book.

The biographies are arranged in six groups covering the ancient world, medieval Europe, renaissance Europe, seventeenth century Europe, eighteenth century Europe, and

nineteenth century Europe and the United States. Of particular interest to military men are Socrates, by Diogenes Laertius; Alexander the Great, by Plutarch; Augustus Caesar, by Suetonius; Jesus of Nazareth, by Luke; Charlemagne, by Einhard; Jeanne d'Arc, by C. A. Sainte-Beuve; Frederick the Great, by T. B. Macaulay; Napoleon Bonaparte, by George Brandes; and Otto von Bismarck, by Emil Ludwig.

The book contains more than seven hundred thousand words, but through a judicious selection of type and paper it has been kept to a very convenient size. This is the most valuable single volume of biography that has appeared in a long time.

Practical Calculus for Home Study. By C. I. Palmer. New York: McGraw-Hill Book Co. 1929. 4¾"x 7¾". 443 p. Il. $3.00.

A concise and readable book, written in non-mathematical language to serve the needs of those who require the calculus as a working tool rather than as a polite accomplishment. It is equally adapted for a general review of the fundamentals of the science or for reference use by those whose college calculus has become rusty.

Only the most sketchy acquaintence with analytic geometry is assumed, and the author proceeds almost directly to the solution of practical problems by calculus methods. As each new portion of the subject or each new class of applications is taken up, numerous illustrative problems are worked out for the student's guidance. These problems are strikingly varied in origin, serve as excellent models, and help to keep up the heart of the beginner. The separate chapters on maxima and minima and on "rate" problems are of exceptional practical value, both for their general hints and their general availability as model solutions. Excellent discussions are given of the mathematics of simple harmonic motion and of damped vibrations. As the author puts the matter, "The subject of calculus cannot be made *easy*, but it can be made *plain*."

The book is completed by the usual tables. It is very well printed and admirably bound.—F. M. G.

An Outline History of the World. By H. A. Davies, M. A. London: Oxford University Press. 1928. 4¾"x 7¼". 560 p. Il. $2.50.

Every history has to be selective, and none more so than general or world history. Selection having been made, there come the questions of proportion and emphasis. One author will stress the military development of nations, another the economic, and a third the political. Historiography is fascinating, but it certainly is not easy and one's purpose in writing should be very clearly defined before the writing is undertaken.

The author announces his purpose as "primarily an attempt to supply schools with a suitable text-book," but one of interest to the general reader. His interest—and his emphasis—may therefore be arranged in order as political, economic, military, and social. Bearing this in mind, we find the book adequate for its purpose.

Of particular interest to us is the author's chapter on the United States, and here we note particularly the impersonal attitude which is the aim of every writer of history. "Business is undoubtedly the dominant interest of most young Americans. . . . Wealth is not, however, worshipped as an end in itself, but rather as a material proof of success . . . with the business instinct there is mixed a considerable strain of idealism. The American, while he strives to make the best of the world as it is, is also only much alive to the need for a better world. . . . The election of Woodrow Wilson . . . was a triumph for idealism, and his project of a League of Nations . . . received considerable support, but the United States declined to join the League, mainly from business instinct." The "good generalship" of General Washington was an important part in the winning of independence. Generals Grant and Sherman were "leaders of the first rank." Lincoln, "if it were possible, came out of the civil war a better man than he was when he entered it."

The book compresses much information in a small space.

Automobile Blue Book, Volumes IV and V. Chicago: Automobile Blue Books, Incorporated. 1928-29. 7¾"x 9½". Il. Maps. $1.00 per volume.

The two volumes cover approximately the following territory: Vol. 4: South from St. Louis—Washington to Baton Rouge—Jacksonville; Vol. 5: South from Baton Rouge—Jacksonville to the Gulf Coast.

The section covered by each volume is shown by a key map on front end-papers, which is subdivided into quadrangles, each indicating a page number on which is found an enlarged map of that section. These larger maps show roads and their conditions, State and U. S. highway numbers, mileage, etc., and the facing page gives Points of Interest, Recommended Accomodations, City Maps, and suggested routes.

The maps are clear and legible, so that "he who rides may read," and the city maps have the main thoroughfares marked so that one is not put to the necessity of asking information on the street.

A very complete index covers location of every town in each volume. The binding is flexible leatherette, and a very convenient edge marking is used, enabling quick reference to any desired map.

The two volumes mentioned are now available, and it is understood that the remaining seven volumes will be issued during the coming Spring. They will be of great value to anyone who contemplates any tour through unfamiliar territory.—W. R. S.

The Tragic Empress. By George Maurice Paléologue. New York: Harper and Brothers. 1928. 264 p. Il. $3.50.

This book bears the descriptive subtitle of "A Record of Intimate Talks With the Empress Eugenia—1901-1919."

M. Paléologue has the greatest admiration and sympathy for that pathetic old woman who, after the loss of her throne, her husband, and her son, used to wander about Europe, as she herself said, like "An old fluttering bat." Also he impresses on the reader her remarkable memory and keen intellect. That she was sincere and frank—at times even brutally so—is quite apparent from all that Paléologue quotes her as saying.

So through the pen of this French Ambassador and Academician the Empress Eugenia presents her case without equivocation. And it is an extraordinary one. In these days it is hard to realize that dynastic glory should have been so powerful a factor in a woman who died but a few years ago.

But, while M. Paléologue presents the Empress' case in all fairness and generally in her own words, his gallic logic forces him sometimes to insert a heavy rebuttal. One gets in this book the interplay of argument and the contrast between the second Empire and the Third Republic.

On Napoleon III's antagonism towards us the Empress was quite clear: "She then reminded me of how, even from 1846, the prisoner of Ham [later Naploeon] had dreamed of setting up in Central America a strong Latin Empire, which would have barred the road against the ambitions of the United States. It was on Nicaragua that he put his first choice, by reason of the facilities he would there have found for piercing a canal between the two oceans. So he had been quick to see the opportunities of a French intervention in Mexico, on the day that Juarez's dictatorship again released revolutionary passions, which at the same time the War of Secession was getting the two harbors of the great neighboring republic against each other for so long a time." And Eugenia herself, in 1861, gave Napoleon's Mexican Adventure "the final and decisive impulse."

M. Paléologue sums up the character of Napoleon in two sentences: "The dreamer of the Tuileries was just then [1855] wavering between the immediate realities of the Austrian alliance and the misty enticements of the Italian mirage. All his counselors were pushing him towards the alliance; but his fantastic imagination could never resist the allurements of a mirage."—S. M.

Whither Mankind: A Panorama of Modern Civilization. Edited by Charles A. Beard. New York: Longmans, Green and Co. 1928. 408 p. Il. $3.00.

This is a remarkable collection of fourteen articles on various aspects of modern civilization, written by such well-known men as Bertrand Russell, Emil Ludwig, Havelock Ellis, John Dewey and Carl Van Doren. It is, in general, a justification of civilization in the machine age and a prophecy of optimism. Difficulties and dangers are boldly set forth, the fact-finding method of science is employed, but the general tone of the book will please the boosting Babbit rather than the carping critic.

Perhaps the most remarkable article is the first, on the civilization of the East and the West, by the Chinese savant Hu Shih. He boldly debunks the old theory that the East is spiritual and the West materialistic, and argues that the reverse is true. Professor Beard's introduction and final summary are excellent.

Emil Ludwig on "War and Peace" and George A. Dorsey on "Race and Civilization" are rather weak. Ludwig takes up most of his space in combatting the arguments of an undefined class whom he calls "the friends of war"—tilting at wind-mills—and arrives at nothing better than this—"If we give our boys tin soldiers . . . teach them the glory of a uniform . . . the prestige of the State . . . the superiority of the fatherland . . . they will seek to attain the goal which has been pointed out to them as the ideal." Dorsey uses most of his pages in a rather spiteful and petty attack on the opposing school of biologists, the believers in race inheritance such as Osborn, Grant, East, Huntington and McDougall, and in the end gives us this charming bit of inter-racialism—"The Savage is a rational being, morally sound, and in every respect worthy of a place in the Universal Brotherhood of Man." For "Savages read Hottentots, Sicilians, Mexicans, Greeks, Jews, Choctaws, and I am still in complete accord." Whereupon the rest of us might sing that well known old song about the Little Brown Brother.

But aside from these two articles the book is excellent, and furnishes another example of the selective discrimination of the Book-of-the-Month Club.—S. M.

The Story of the Gypsies. By Konrad Bercovici. New York: Cosmopolitan Book Corporation. 1928. 294 p. $4.00.

This book is really a collection of notes on the strange people, the Gypsies. Bercovici himself is a Roumanian. His childhood seems to have been passed in close contact with Gypsies, and he has wondered all over the World studying them.

He thinks they were originally Jats, of the Sudra (the lowest) caste in India. These people were enslaved by the early Hindu conquerors, and gradually filtered out into western Asia and Europe. This infiltration began, probably, at a very early date and has continued up until fairly recent times. The great European center of the Gypsies seems to have been Macedonia, perhaps through the Asiatic conquests of Alexander. From this center as a breeding ground they have spread west throughout Europe and America (the United States and Brazil).

Bercovici sees in them an entirely different conception of civilization from that of the rest of the World. The Gypsies have no words for "possession" or "duty." Their controlling passion is for freedom in its broadest sense, unabridged by possessions or by duties to any state or community. Their marriage vows, for instance, specifically bind a couple only so long as love lasts. As Bercovici puts it, their "Ancestors were of the last of those who lost their wings. The gypsy is still practically in the bird stage."

The driving power behind this intense centrifugal spirit seems to be a very strong superiority complex. The gypsy not only rejects our conception of a settled civilization, based on possessions and duties, but believes himself to be superior to it and to us. This, coupled with his extraordinary cult of the dead (his dead), has enabled him to survive in

all lands, in spite of almost incredible persecution he has everywhere encountered. In fact Bercovici claims that the more he has been persecuted the more persistently he has infiltrated.

In agricultural countries especially the Gypsies have prospered, due to their innate genius for work in metals, for home trading and for entertainment. They have conformed to local prejudices only so far as has been necessary to maintain their happy freedom. And always and everywhere they are a happy people.

Having no religion of their own, they have adopted the outward forms of the religion of the country they happened to be in. It is an extraordinary fact that no gypsy is known to have been killed by the Inquisition.

And yet, in spite of all these traits which keep them a people apart from all others, the Gypsies in every land have succumbed to a certain extent to the influence of the national life surrounding them. Their environment has changed them so that they differ greatly, the Spanish from the Roumanian, the English from the Hungarian. Bercovici thinks that they can best be studied here in America, since we have attracted all kinds; and, were it not for our immigration laws, we would probably end by having the whole lot.

The book is interesting, because of its strange subject. The gypsy legends and proverbs are particularly to the point. But it is curiously jumbled—a book of many repetitions, of sudden breaks and starts, a hodge-podge of ideas and suggestions rather like the Gypsies themselves.—S. M.

The Story of Oriental Philosophy. By Lily Adams Beck (E. Barrington). New York: Cosmopolitan Book Corporation. 1928. 429 p. Il. $5.00.

Whether she writes under the name of Beck or Barrington, whether it is Eastern mysticism or Western biography, her books are well worth reading. This one gives an excellent summary of Indian and Chinese religious philosophy, with short chapters on Persian Sufism and Japanese Shintoism. It is not philosophy in the ordinarily accepted Western sense, but rather religious theology on which she writes. But in studying the various theologies of the Orient, Mrs. Beck is attempting to get down to the foundations of Eastern thought. She sets herself a very great task, and she accomplishes it in a simple, straightforward way, quoting liberally from original sources and interpreting them into plain English.

One half of the book is given over to Indian "philosophy." Mrs. Beck is much impressed by the mysticism of the Vedas and the basic conception of Brahmanism and Buddhim. She devotes several chapters to the life and teachings of the Buddha, condensed from her previous book, "The Splendor of Asia."—S. M.

Sceptical Essays. By Bertrand Russell. New York: W. W. Norton and Company, Inc. 1928. 256 p. $2.50.

Possible Worlds. By J. B. S. Haldane. New York: Harper and Brothers. 1928. 305 p. $2.50.

Both of these books are collections of random essays written for the layman in layman language. Both deal with various aspects of the philosophy of modern science. Both are written in the scientific spirit of scepticism and, curiously enough, both suggest grave doubts as to the logical foundation of science itself. Russell even goes so far as to suggest that the present doctrine of pure science may become nullified by the inability of scientists to accept its logic.

Both of these books are interesting and stimulating.—S. M.